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ELECTRICAL WORLD

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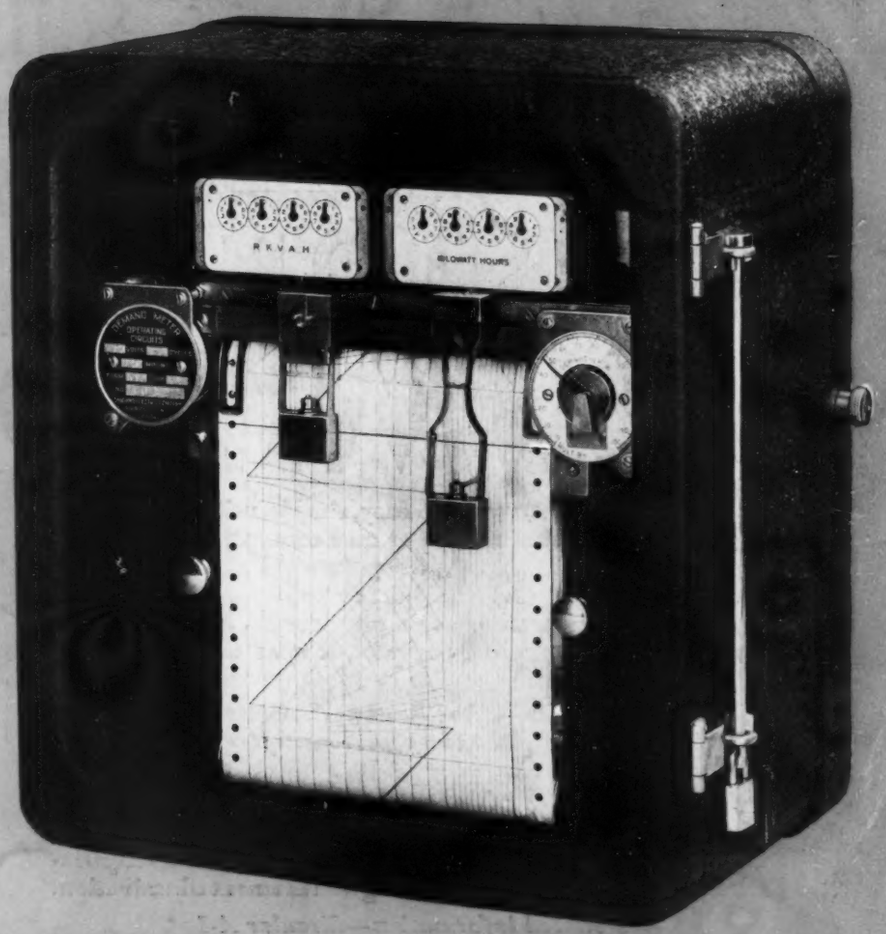

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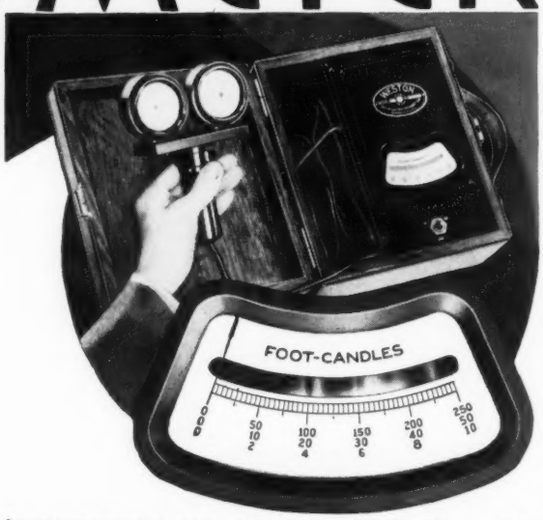

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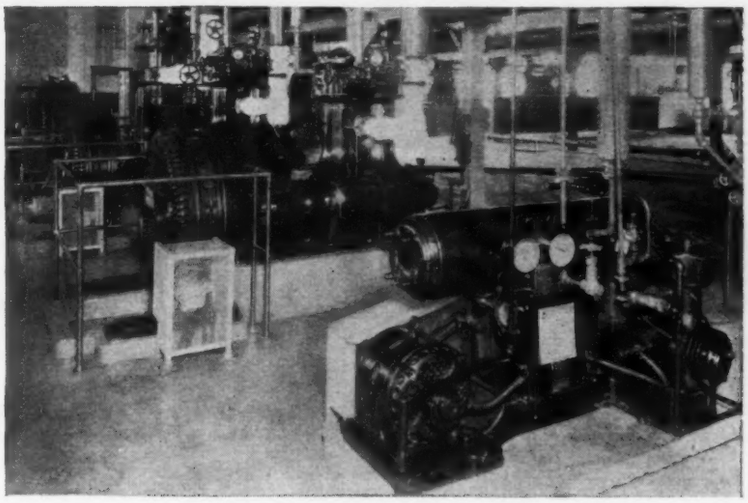

Compressor installation, Mountain Ice Company

DECEMBER 12, 1931

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ELECTRICAL WORLD

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for the Week Ending

December 12, 1931

Water power an economic fallacy?

—**Steam is best power source,** concludes George A. Orrok upon the basis of analysis of hydro-electric potentialities, characteristics, locations and national rainfall data. Technical advances considered, too—*p. 1036.*

—**A fair chance for regulation** is the plea of ex-Judge Ransom of New York, veteran utility defender, who sees opportunities lost in valuation squabbles and because of understaffed, underpaid commissions—*p. 1041.*

The greatest possibilities of decreased power costs to all consumers, both domestic and commercial, will result from more intensive use of present demands quite as much as through savings that may be effected by the utility in producing and distributing the electric power.

A. G. CHRISTIE,
Professor Mechanical Engineering
Johns Hopkins University

Smith sustained as power chairman

—**Rate discussions loom up** as new year approaches. Narragansett simplifies, P. G. & E. sees budget threatened, P. S. of N. J. shaves tariff, Potomac Electric contests, California commission scrutinizes rural charges—*p. 1028.*

—**Service hazards were reduced** in the rehabilitation of a New England steam station. Work included improved sectionalization of buses, the isolation of reactors and the reconstruction of bus supports—*p. 1044.*

—**Advantages of buried cable,** so widely used abroad, suggest its inclusion in American underground practice to a greater degree than now prevails. There are some disadvantages, however—*p. 1054.*

Joint co-ordination of wiring under way

—**Uniform promotion of wiring** took another stride toward accomplishment when representatives of six electrical associations met in a joint industrial conference to formulate the policies assented to last July—*p. 1026.*

—**Co-operation in merchandising** brought award to chief executive of Central Hudson Gas & Electric Corporation. Development of all-electric homes was goal which united the various electrical interests—*p. 1050.*

—**Range of Christmas lighting** offers opportunities for application for home, shop, office and highways. Each year sees more attention paid to this spectacular work by lighting men. Some typical examples—*p. 1052.*

Working out merchandising co-operation

Hoover Again Gives Views on Interstate Transmission

TWO SHORT PARAGRAPHS in President Hoover's annual message to Congress, presented on Tuesday, have special relevancy to the light and power industry. They refer to interstate intermission of electricity and to Muscle Shoals and are as follows:

I have recommended in previous messages the effective regulation of interstate electrical power as the essential function of the reorganized Federal Power Commission. I renew the recommendation. It is urgently needed in public protection.

At my suggestion the governors and legislatures of Alabama and Tennessee selected three members each for service on a committee to which I appointed a representative of the farm organizations and two representatives of the War Department for the purpose of recommending a plan for the disposal of these [Muscle Shoals] properties which would be in the interest of the people of those states and the agricultural industry throughout the country, I shall transmit the recommendations to the Congress.

▼

Harrison Lighting Institute to Be Discontinued

CLOSING OF THE General Electric Lighting Institute at Harrison, N. J., as of December 15, has been announced by J. E. Kewley, manager of the incandescent lamp branch of the General Electric Company at Nela Park, Cleveland. The move followed the acquisition of the Electrical Institute in Grand Central Palace by the Electrical Association of New York, of which body General Electric is a contributing member. It is the plan of the New York Electrical Association to continue to make lighting demonstrations one of its major activities, and since the New York institute offers similar facilities and is more centrally located than the Harrison institute, it has been considered inadvisable to continue operation of the institute at Harrison.

The Eastern office of the Nela Park engineering department, with A. L. Powell in charge, which heretofore has been at Harrison, will be transferred from that place to New York City on or about January 1, at an address to be determined later.

▼

Safe Harbor Starts; Beats Schedule Nine Months

NINE MONTHS AHEAD of schedule, the first of the six 42,500-hp. generators that will compose the initial development of the Safe Harbor Water Power Corporation on the Susquehanna River in Pennsylvania went into operation on Monday last, December 7, transmitting power to Baltimore over the Pennsylvania Water & Power Company's just finished 70-mile, 220-kv. line to that city. Another unit was ready to go into operation this week, and just after New Year's two more will be ready. Ultimately there will be twelve generating units, giving the station a rating of more than 500,000 hp.

The entire initial output will be purchased by the Pennsylvania Water & Power Company and the Consolidated Gas, Electric Light & Power Company of Baltimore and will enable the latter to supply under a twenty-year contract all the electric requirements of the Pennsylvania Railroad from the Susquehanna crossing through Baltimore to Washington. The contract is believed to govern one of the largest sales of power ever covered in a single agreement.

This great hydro development was described fully in the ELECTRICAL WORLD for last week (page 992).

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Joint Conference Starts Working for Adequate Wiring Co-ordination

CARRYING out the recommendation made earlier this year at Association Island, a joint industry conference was held in New York on December 7 at which the first steps were taken to co-ordinate the various specifications which have been made for adequate wiring of residences and apartments. The conference was composed of representatives of the Illuminating Engineering Society, National Electrical Manufacturers' Association, National Electrical Wholesalers' Association, Society for Electrical Development, National Electric Light Association and the Association of Electragists International, the last named on an informal basis. Twelve men were present besides the chairman — E. A. Brand, Buffalo, Niagara & Eastern Power Corporation.

Using the "Guide to Planning Electrical Wiring" of a residence or apartment prepared by the Society for Electrical Development as an outline, the conference took up topic by topic the elements embraced and compared for relative desirability the corresponding recommendations made by the Electragists, the N.E.L.A. and President Hoover's home-building conference. This being the first meeting of the joint industry conference, only fundamentals were discussed. From these a tentative industry recommendation will be prepared for more detailed discussion at a later meeting in January. The adaptation of the favored recommendations to the opinions expressed by the conference members is being left to J. S. Bartlett, Society for Electrical Development. Efforts will be made to prepare recommendations without reference to specific materials.

Before the next meeting it is intended to ascertain whether better utilization of circuits can be obtained economically by routing them so that diversity between use of outlets can be capitalized and whether it may be economical to divide the services in each room between two circuits extending to other rooms so that blowing of a branch circuit fuse will not completely interrupt service in any room.

After the co-ordinated recommendations are prepared and approved by the joint industry conference committee it is intended to submit them for the general approval of the industry. At that time it will also be decided who shall sponsor the recommendations and what they shall be called. Decision will also have to be made on whether the recommendations shall be divided into technical and educational pamphlets or some other combinations.

▼

Washington and Albany Discuss St. Lawrence

REPORTS FROM WASHINGTON say that Delos M. Cosgrove, vice-chairman of the New York Power Authority, recently conferred there with James G. Rogers, Assistant Secretary of State, who is in direct charge of the St. Lawrence River treaty negotiations. Press assertions are made to the effect that New York State may give up its preference for a one-dam development and accede to the Canadian plan for two dams, one at Barnhart Island, at the northeastern end of the international section of the river, and the other at Chrysler Island, which the Canadians are now thought to prefer to Ogden Island.

The Joint Engineering Board of the United States and Canada is expected to meet soon to study technical aspects of the problem, particularly those involved in the dam construction. The time and place of this meeting have not yet been announced. In the meantime the governors of Middle Western states are pressing for the expedition of the treaty, the navigational features of which would make seaports of ports on the Great Lakes.

ELECTRICALLY OPERATED DREDGE ON TRINITY RIVER, TEX.

To help build a new industrial development near Dallas this work has been under way. The energy supplied is 2,300-volt, three-phase. A pole to extreme left joins conductors shown in foreground to armored three-wire submarine cable. This cable is supported at short intervals by pontoons to the right.

▼ ▼ ▼

Middle West Utilities Financing Is Scanned

VARIOUS FINANCIAL EPISODES in the history of the Middle West Utilities Company and its subsidiaries were the subject of testimony on December 2, 3 and 4, when the Federal Trade Commission's inquiry into this Insull group of properties was resumed. The first day's session was noted last week (page 983).

A. R. Colbert, commission examiner, told of the acquisition by the Middle West Utilities of the Central Illinois Public Service Company in 1912, when the Central Illinois had $310,000 capital stock outstanding. Very rapid growth ensued. On September 30, 1930, the Central Illinois company had issued shares of common stock which were carried at a stated value of $21,909,450. The holding company, the testimony set forth, paid $17,072,701 for these shares, or $4,836,748 less than their stated value.

Mr. Colbert testified also that a book profit of $2,219,056 resulted from the organization by Middle West in 1925 of the Central & Southwest Utilities Company, a holding corporation which was formed to take over Middle West's interests in the Southwest territory.

It was set forth that $2,000,000 par value of common stock acquired with the Northwest Utilities Company in 1918 cost Middle West nothing, being turned over to it as a bonus or for services in the transaction, although issued by Northwest for securities.

Another transaction testified to was that as of June 30, 1930, Middle West loaned on intercompany notes a total of $30,502,396 and that the largest amount of this total was due from the Mississippi Valley Utilities Investment Company, this sum being $11,670,415.

A vendor's contract account which had a balance of nearly $10,000,000 at the end of 1925, it was testified, was written off at that time by charging most of the account to surplus and the remainder to a reserve for discount on company's securities created through appropriations from surplus. At the same time this amount was written off, the examiner said, investments were written down by nearly $9,000,000 and this amount credited to surplus. Gross income of the company from organization to September, 1930, from cash dividends on subcompanies' stocks amounted to nearly $50,000,000 and interest on bonds and debentures of subcompanies to more than $11,600,000. Profits on sales of securities or property to subsidiaries amounted to more than $17,700,000, while profits on sales of securities to outside companies totaled in excess of $8,200,000. Mr. Colbert testified that in the organization of the New England Public Service Company in 1925 Middle West conveyed securities and assets totaling $13,824,380 and acquired securities having a ledger value of $16,237,500, netting a profit of $1,227,994. In the transfer of properties by Middle West to the Twin State Gas & Electric Company, which came under control of the holding company in 1912, it was brought out that properties which cost Middle West $424,115 were set up on the books of Twin State at $1,887,266.

M. J. Insull Queried on Special Item

At the session on Tuesday of this week Martin J. Insull, president of the Middle West Utilities Company, testified that he had no knowledge of the destination of $44,100 which was charged to the expense account of the company but was unexplained on the books. Mr. Insull said that this fund, which was the sum of four or five transactions, was turned over by a special requisition addressed to E. A. Davis, then auditor of the company, in the early part of 1926, but that he did not know to whom the cash was delivered.

Chief Counsel Healy referred to the then impending senatorial election in Illinois and to Samuel Insull's admitted contributions to political organizations at that time and asked Mr. Insull if he would state on oath that the $44,000 was not involved in these contributions.

"I can't say," Mr. Insull responded, in effect, "because I don't know what it was used for. If I knew what it was used for, I would tell you. All I can say is that not to my knowledge was this money used for this purpose."

Commissioner Edgar A. McCulloch, presiding, also interrogated the witness. "There ought to be some one in your organization who could give us some information as to how this money was used," he said. "I don't know of anybody who knows." Mr. Insull replied. "Those are three or four items out of thousands of items that happened," and this is six years ago."

Commissioner McCulloch asked if money was often disposed of in this way so that it "disappeared in the air." "It was for some purpose I deemed to be of interest to the company, I presume," the witness said.

Mr. Davis, called to the stand, testified that the funds in question were first charged on the company's books to the expense account, under the subaccount "subscriptions, dues and donations," and later charged to an "equalization" account. He said that the amount was put on the equalization account so that it could be spread over several months.

Frank Buckingham, examiner, gave testimony in connection with an investigation he conducted of the books of the Northwest Utilities Company, a subsidiary holding company of the Middle West system which serves 413 communities. He testified that the company at the end of 1929 owned virtually all the common stocks of the Lake Superior District Power, the Northwestern Public Service and the Wisconsin Power & Light companies.

P. G. & E. Says Rate Cut Will Jeopard 1932 Budget

"THERE IS NO JUSTIFICATION for the present attack on our rates," declared A. F. Hockenbeamer, president Pacific Gas & Electric Company, last week, referring to the reopening of rate cases filed several years ago by San Francisco, East Bay cities and peninsula municipalities and deferred until rates put into effect at that time were tried out. "Our electric rates have been repeatedly reduced in the last four years and are today probably the lowest to be found anywhere in any like area in the United States. This is no time to rock the boat.

"Our construction budgets," Mr. Hockenbeamer went on, "covering all departments of the company's business, but not including maintenance, operating expenses, taxes and the like, indicate that we could advantageously expend between $31,000,000 and $32,000,000 in 1932. If necessary, a substantial number of contemplated improvements could be deferred. Political attacks on our rates, if persisted in as they have been for the past two years, will undermine our credit and make it just that much more difficult to go ahead with new work that will give employment to a large number of people."

Before the California Railroad Commission Assistant District Attorney Dion Holm of San Francisco, who also acted as spokesman for the East Bay, Palo Alto, San Jose and the California Farm Bureau Federation, declared that the Pacific Gas & Electric Company and the Great Western Power Company had earned excessive profits during 1930 and the first ten months of 1931. He demanded that the two utilities produce a detailed account of financial transactions, including profits and operating expenses, since January 1, 1930.

Commissioner Clyde L. Seavey, president of the commission, who conducted the hearing, granted the request and ordered the companies to produce the figures by January 1. Hearings were set for March 15.

▼

New Jersey Public Service Cuts Residential Rates

A NEW SCHEDULE of electric rates, calling for a reduction from 8 to 7 cents per kilowatt-hour in the 40-to-50 kilowatt-hour block, was filed last week by the Public Service Electric & Gas Company with the Board of Public Utility Commissioners of New Jersey. It becomes effective with January bills. The saving to consumers is estimated by Public Service rate experts to be about $600,000 annually.

The present residential base rate of 9 cents per kilowatt-hour for the first 20 kw.-hr. is unchanged. The present second block of 30 kw.-hr. at 8 cents is divided into two blocks—20 kw.-hr. at 8 cents and 10 kw.-hr. at 7 cents.

Thus persons using only 40 kw.-hr. per month will pay the present rate of $3.40. A person using 50 kw.-hr. a month would pay $4.10 instead of $4.20. For consumption in excess of 50 kw.-hr. the residential rate will be 3 cents as at present.

▼

AN AVIATION BEACON IN CZECHOSLOVAKIA

—*Wide World Photos*

From this 120-ft. tower on a hilltop near Prague a 1,000,000-cp. searchlight is thrown vertically, breaking through clouds, rain and fog.

▼

Rural Rates Scrutinized by California Officials

THAT THE California Railroad Commission is seeking a means of developing an agricultural power rate schedule that would not put an unusual burden on agriculture at times of drought, depression and similar afflictions was indicated by a question put by Commissioner W. J. Carr at a recent rate hearing. "The thing that is bothering me," said Mr. Carr, "is that I don't know of any other business that is unusually profitable in a period of some visitation of a more or less severe degree in the section in which it operates." Mr. Carr went on to suggest that the power companies could "take less profit in dry years" and that this could be accomplished by revising tie-line schedules or the agricultural rate, or both.

Testimony at the hearing brought out the fact that in dry years the demand for agricultural power is increased by the lack of surface water for irrigation, making it necessary for farmers to increase their pumping.

▼

Simplified Domestic Rate for Rhode Island Utilities

AT LEAST $200,000 per year will be saved by the 103,000 residential customers of the Narragansett Electric Company, Providence, and $15,000 by customers of the South County Electric Company, both subsidiaries of the New England Power Association, according to estimates of the effect of new rate schedules to be adopted January 1 with a view toward simplifying charges for electricity in this territory. Three former residential rates are superseded.

The new Narragansett rate applies to all uses of electricity in the home and ranges from a minimum bill of 50 cents for the first 3 kw.-hr. delivered per month down to 2 cents per kilowatt-hour for all energy in excess of 250 kw.-hr. After the first 3 kw.-hr. per month the unit rate for the next 60 kw.-hr. is 6.5 cents, for the next 30 kw.-hr. 4 cents and for the next step 3 cents. The so-called service or investment charge of 50 cents per month is eliminated. No room or area rate is imposed. The simplified rate announced is thought to be highly promotional in character.

The South County rate follows the same general design.

▼

Potomac Consent Decree May Give Way to New Base

LATE IN JANUARY the Public Utilities Commission of the District of Columbia will, it announces, hold a public hearing on the rates of the Potomac Electric Power Company. It will be remembered that an adjustment was in force for seven years under which the company was permitted to earn 7½ per cent on its valuation, half of any profit in excess of this amount being made the sum total of a reduction in rates for the ensuing year.

Last year, on the claim that the company was making a profit of 10 per cent, the commission attempted to abrogate the agreement and adopted a new sliding scale, under which 7 per cent is the approved return. If profits exceed 7 per cent but are not more than 8 per cent, one-half the excess is to be the amount of the reduction; if the excess is between 8 and 9 per cent, three-fourths will be the amount; if it is over

9 per cent, rates will be reduced by five-sixths of the excess receipts of the utility.

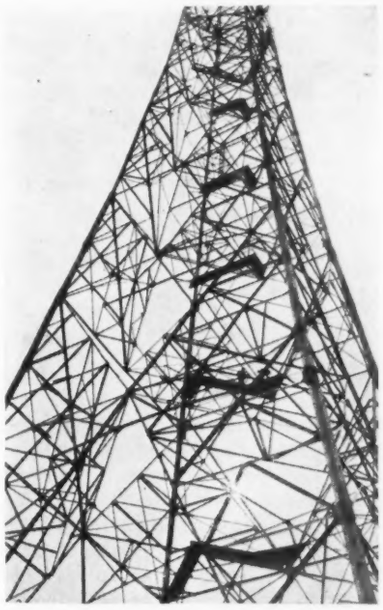
The company resisted this order and took the case into court, where an early decision is expected. If the commission wins and enforces its new scale, a domestic rate possibly as low as 3.7 or 3.6 cents per kilowatt-hour will ensue. The rate is now 4.2 cents—one of the very lowest in the country.

▼

High Towers a Feature of British Electric Plan

AN IMPRESSIVE new landmark for London will take final shape in the near future when the erection is completed on the banks of the Thames of two towers approximately 490 ft. in height to carry electric cables across the river from the big Barking power station to the Kent countryside.

These towers will be a notable feature of the Central Electricity Board's national "grid" project. They will bear six or eight 132-kv. conductors, each of which will cost $100,000 to carry across the river. The span of the cables will be 3,000 ft., and the clearance above the river at the center will be 250 ft. Comparison may be made with the towers just completed on each side of the



Section of one of the towers under way on the Thames

Mississippi at Memphis and illustrated on this page. These, carrying a 4,300-ft., 110-kv. span, are 435 ft. high.

A smaller tower, 330 ft. in height, will be constructed in Essex as part of the English grid to lift the cables over the River Roding. This will compare with the 350-ft. towers on the Clyde at Renfrew, Scotland, and the 340-ft. towers, with a 3,500-ft. span, on the River Forth, near Edinburgh.

An interesting feature will be provision for installation of an electric elevator running up the center of the tower to the level of the bottom cross-arm, should this be found desirable as the result of experience. Each cross-arm will have a rail from end to end outside the tower framework designed to carry a travelling chain to be used for maintenance facilities. There will be platforms about 8 ft. below each cross-arm.

▼

Drought Conditions Are Improved in the South

POWER GENERATION conditions were much relieved last week in the Southeastern States by rainfall over most of the hydro territory that has been hard hit in recent months because of low stream flows. Precipitation ranged from 2 in. to nearly 5 in. The slow, steady rains that occurred resulted in more than usual percolation into the thoroughly dry soils of the watersheds. Most of the streams on which there are hydro developments none the less rose enough to permit considerable reduction in the use of steam reserves. In fact, at least one large steam plant is entirely off the line.

Competent observers believe, however, that unless the rainfall between now and next summer is much in excess of normal, there will be a still greater shortage of hydro power in the Southeast in the fall of 1932.

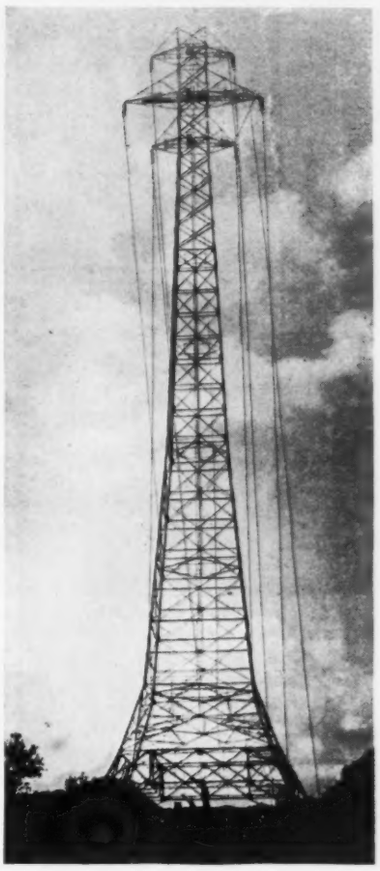
▼

Massachusetts Commission Opposes Loans by Utilities

PROHIBITION OF LOANS by electric and gas utilities, except limited amounts to employees, is recommended to the Massachusetts Legislature by the state Department of Public Utilities, which says that utilities are not organized "to engage in the business of lending money" and that loans by operating companies to holding companies and other operating utilities "can be used as a device to force the sale of stock" and otherwise operate adversely to the public interest.

The department also recommends that a change be made in the law relating to the burying of electric wires which would provide that municipal governments may require that wires be placed underground after notice has been given to the persons interested. Appeal from the action of city or town officials in this respect would be afforded.

RIVER TOWER AT MEMPHIS



The 435-ft.-high "power bridge" across the Mississippi at Memphis was described on November 28 (page 942). One of the three-conductor cables was strung by the crew of E. T. Brown, superintendent Arkansas Phoenix Utility Company, in nine hours.

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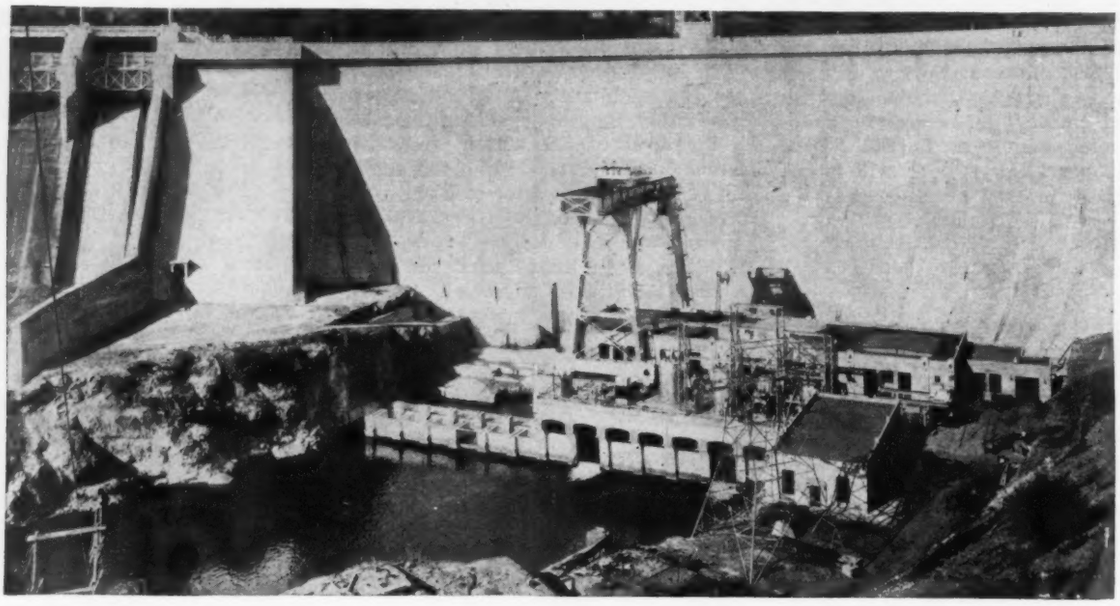
Drumm Battery Successful in Demonstration Trip

SUCCESS WAS ACHIEVED in Ireland on Wednesday of last week for the Drumm battery method of electric propulsion when a train carrying President Cosgrave, James Drumm, the inventor, and other passengers made a demonstration run from Dublin to Bray, 13 miles distant, and back. A special dispatch to the New York *Times* says that the train gained speed with much ease, its power of acceleration being one of its chief characteristics. Its average speed was 45 miles an hour, although occasionally it reached 60 on tracks with no grade. Recharging of the batteries at Bray occupied fifteen minutes, and the return journey was accomplished in 24 minutes. (See ELECTRICAL WORLD, August 16, 1930, page 285, and November 29, 1930, page 985.)

LATEST VIEW OF ARIEL HYDRO-ELECTRIC PLANT ON LEWIS RIVER, ORE.



This plant, 32 miles north of Portland, Ore., will soon be turned over by the Inland Power & Light Company to the Northwestern Electric, which will operate it. The plant contains a 45,000-kw. General Electric generator connected to a 61,000-hp. S. Morgan Smith turbine. Full normal head is 185 ft. The power house will accommodate another unit, and provision is made for still two more. A 350-ton Gantry crane spans the power house. The dam is 1,251 ft. long and 313 ft. high.

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Smith Upheld as Power Board Chairman

CONFIRMATION of the right of George Otis Smith to the chairmanship of the Federal Power Commission was the outcome of the suit in the Supreme Court of the District of Columbia to unseat him, this decision being handed down on December 5 by Justice Gordon, who said:

"Constitutional theory, parliamentary usage, Senate precedents and considerations of practice procedure alike lead to the conclusion in the instant case that when the Senate in conformity with its own rules unanimously ordered notice of consent to be sent to the President, it once and for all surrendered its control of the matter and its rights to reconsideration and left the Executive free to make a constitutional appointment."

Senator Walsh of Montana, leader of the attempt in the Senate to recall that body's approval of the appointment of Mr. Smith, said that the case would be taken to a higher court.

It will be remembered that Mr. Smith and two other members of the Power Commission, after appointment by the President and confirmation by the Senate, met, organized and dismissed three employees of the former commission who had been the center of a senatorial storm. These employees were Frank E. Bonner, executive secretary, accused by some senators of favoring utility companies, and William V. King, chief accountant, and Charles A. Russell, solicitor, regarded by the same senators as the defenders of public rights. When the dismissal of Messrs. King and Russell became known the Senate demanded that the names of the three commissioners who dismissed them be returned to it, the intent being to rescind the previous approval of their nomination. President Hoover refused to return their names, and both sides engaged eminent counsel to test the constitutional question involved in the courts, the Senate limiting its attack to Mr. Smith. Subsequently the commission reappointed Mr. King, and it has evinced no tendency to surrender any of the regulatory rights which it claims under the water-power act.

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Central Connecticut Sold to U. G. I. Property

ARRANGEMENTS HAVE BEEN MADE for the acquisition early next year of the Central Connecticut Power & Light Company by the Connecticut Light & Power Company of Hartford. The Central Connecticut company has been owned and managed since February, 1928, by the New England Water, Light & Power Associates of Providence, R. I. The company serves seventeen small towns in the heart of Connecticut and has about 8,000 customers. Most of its energy is purchased.

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Scattered Happenings in the Electrical Sphere

UNITED STATES

Radio City's Electrical Requirements

Connected power load for "Radio City," the great development in the center of New York City which John D. Rockefeller, Jr., is financing, will be in excess of 24,000 hp., according to engineers, and a contract signed with the Union Electric Light & Power Company is based on an estimated annual consumption of more than 32,000,000 kw.-hr. The energy will be supplied from the electric company's Hell Gate station over eight special feeders with a total capacity of 48,000 kw. The lighting of "Radio City" will be especially elaborate, with spectacular floodlighting effects.

Long Fight Over Austin Dam Ended

Approval has been given by the United States District Court at Austin, Tex., of an agreement reached between

the city of Austin and the Austin Dam, Inc., present holder of the franchise for a power dam on the Colorado River. The judgment, which ends sixteen years' litigation, provides that the dam and its appurtenances become the property of Austin, which will lease it to the Austin Dam, Inc., for 40 years, the lessee supplying the city with 4,000,000 kw.-hr. a year without cost. The company announces that it will spend $1,500,000 in the rehabilitation of the structure and make its capacity 8,100 kw. The structure will be raised to a height of 60 ft. Work need not begin before November 30, 1933, but operation must begin in 1935.

Northern States Buys Power House

An order has been issued by the Wisconsin Public Service Commission permitting the Northern States Power Company to purchase the dam and power house of the Cornell Products Company at Cornell for $1,000,000, a reduction of $500,000 from the amount the company had contracted to pay for the property. The order points out that the power company has agreed to lease the water power back to the Cornell Products Company for five years.

Puget Sound Wholesalers Organize

To promote the welfare of the wholesale electrical industry in Seattle and Tacoma trade territories, the Puget Sound Electrical Wholesalers' Association has been organized. For the first year the work of the association will be handled by a secretary-treasurer, and the management of its affairs will be vested in an executive committee of five members.

Power Survey for Montana

Engineers from the National Forest Service are making a survey of water powers within the timber preserves of Montana, to determine the location and capacity of all such sites. Previous records have given a total of 1,104,000 hp., embracing the Clark's Fork, Kootenai, Madison, Missouri and Yellowstone watersheds.

Alabama Power Promotes Rural Service

Through the coming winter months the Alabama Power Company will continue meetings to the total number of about 100 in communities served from rural lines. The meetings are for the purpose of showing customers how their electric service can be made more valuable to them. These meetings, according to E. C. Easter, chief agricultural engineer, consist in three divisions of the company's territory of a presentation of 24 lantern slides and a two-reel motion picture. In the other three divisions they consist of a talk followed by a motion picture. These meetings began in the Mobile division on October 19 and will continue through February.

Little Rock Plant Sale to Go to Vote

By decision of the Arkansas Supreme Court the sale to an individual of the idle municipal electric lighting plant of Little Rock, authorized by the City Council several months ago, the price fixed being $10,500, must be ratified by the voters to become effective. Delivery of the plant had been prevented by petitioning ratepayers

Utility Aids Logan (W. Va.) Unemployed

As soon as official confirmation of the government's approval of the application of the Appalachian Electric Power Company to construct a dam across the Guyan River at Logan, W. Va., is received work will be started on the project, which, at a cost of $75,000, will not only materially increase the value of the company's plant but will also add to the beauty of the river banks and aid sanitation. In planning the expenditure the company had relief of unemployment in mind.

Lighting Syracuse Company's New Offices

Not a single lamp will show on the outside or the inside of the Syracuse Lighting Company's new office building, now approaching completion, all light being from indirect or concealed sources. The company is reported as desiring to have the building, which is built of stainless steel, brick and glass, serve as a model for future experiments in concealed lighting. There will be 1,000 different circuits which can be controlled individually or as a unit from a central control room.

St. Louis Store Asks Large Rebate

Suit to recover alleged excessive charges of $400,000 by the Union Electric Light & Power Company of St. Louis since 1924, when it acquired the stock of the Cupples Station Light, Heat & Power Company, has been brought by the May Department Stores Company, which says that the terms of a contract made in 1912 have been enforced against it and that the Cupples Station company has been kept in existence on paper for the sole purpose of maintaining this contract in force. The utility company contends that inasmuch as the department store, with full knowledge of the case, has never applied to the Public Service Commission to be put under the Union Electric's regular schedules, it cannot now ask for a refund in the courts.

Albuquerque Gets Lower Rates

A reduction of 1 cent a kilowatt-hour in lighting rates in Albuquerque, N. M., has been announced by the Albuquerque Gas & Electric Company, and the minimum charge for residence lighting has been reduced from $1.50 to $1.25. Loss of revenue, as based on present consumption, will be 15 per cent, the company says.

Rate Inquiries Coming in Idaho

In January the Idaho Public Utilities Commission will begin an investigation into the rates of the Washington Water Power Company, and in February it will inquire into the rates of the Utah Power & Light Company.

Vagaries of Municipal Ownership

Seymour (Tex.) officials have been temporarily enjoined from enforcing an ordinance establishing a minimum rate for electric service higher than that charged by the Texas Electric Service Company. The city and the company operate competing plants, and the injunction was sought by the company. The court said it did not understand why the City Council wished 300 citizens, patrons of the old utility, to be forced to pay higher rates.

CANADA

Rural Service in Quebec Province

Farmers in Quebec are urging the government to help them get more electric service and lower rates. Particular complaint is made concerning a minimum monthly charge of $3 imposed by power companies. Premier Taschereau and the Public Service Commission are studying the situation.

Favor Saskatchewan Hydro Scheme

A large hydro-electric project on the Saskatchewan River, near Fort à la Corne, is declared "economically feasible" in an engineering report prepared for the Saskatchewan provincial government. The plant, it is said, could be constructed for a total cost of $12,200,000 and would generate 125,000 hp. The report finds that the Fort à la Corne site can be developed economically for this output, instead of the originally contemplated 90,000 hp. The proposed power site is approximately 40 miles east of Prince Albert, 110 miles from Saskatoon and 190 miles from Regina, these three cities together with Moose Jaw entering largely into the proposals for transmission lines and the marketing of the power.

Coming Meetings

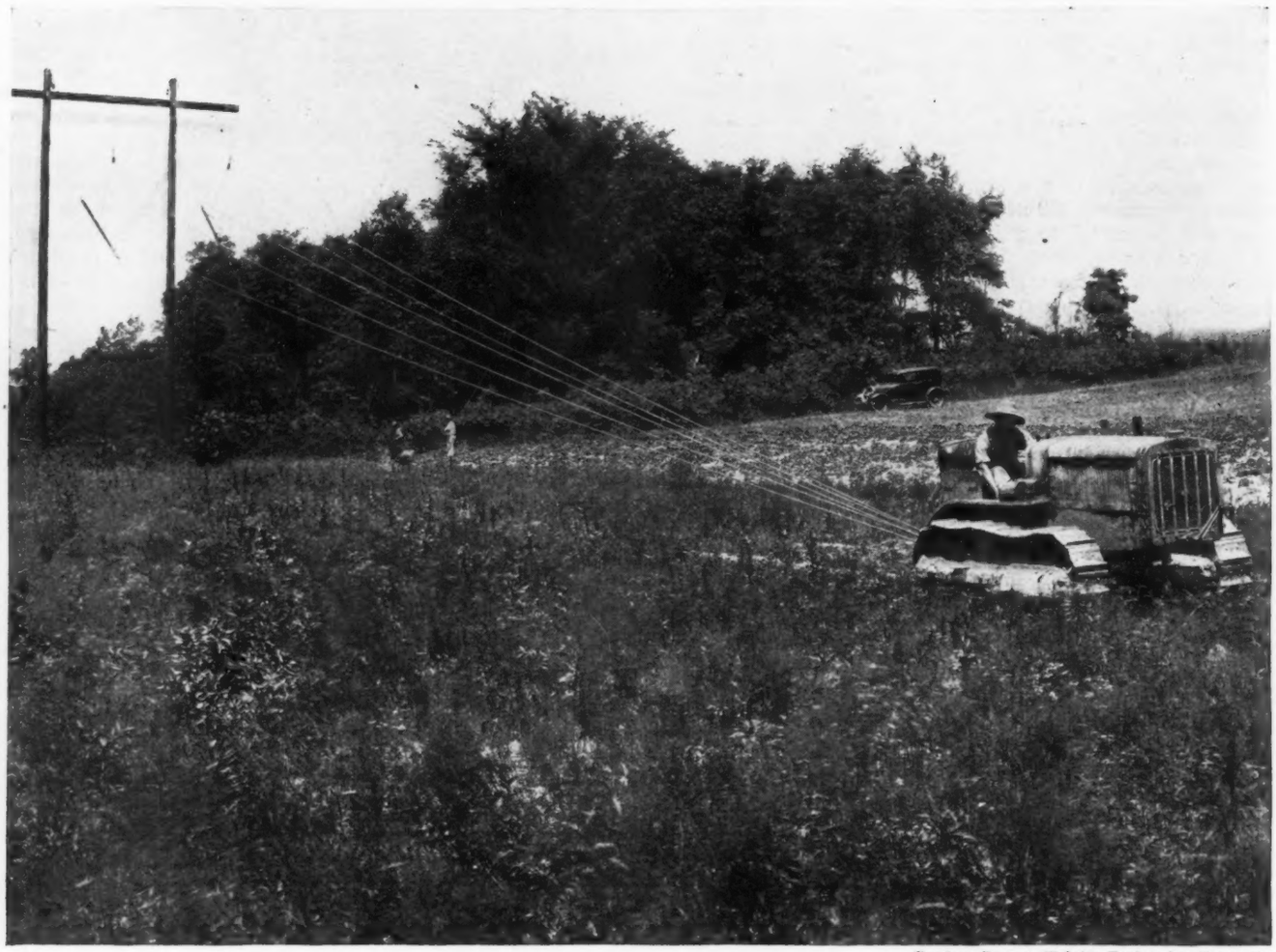
American Engineering Council—Washington, Jan. 14-16. L. W. Wallace, 744 Jackson Place, Washington, D. C.

American Institute of Electrical Engineers—Winter convention, New York, Jan. 25-29. F. R. Hutchinson, 33 West 39th St., New York.

Conference of Electrical Leagues—Philadelphia, Jan. 25-27. Society for Electrical Development, 420 Lexington Ave., New York.

North Central Electric Association—Commercial Section, Lowry Hotel, St. Paul, Jan. 29 and 30; Engineering Section, St. Paul Hotel, St. Paul, Feb. 22 and 23. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

National Electric Light Association—Group committee meetings: Engineering National Section, New York, Feb. 1-5; Accounting National Section, Statler Hotel, St. Louis, Feb. 15-17. A. J. Marshall, 420 Lexington Ave., New York.



Courtesy Stone & Webster Engineering Corporation

Mass production utilized on Bagnell-Page transmission line

Three conductors and two ground wires were strung simultaneously for the Bagnell-Page transmission line of the Union Electric Light & Power Company, St. Louis, Mo. Tractors speeded construction work and reduced labor requirements here.

EDITORIALS

L.W.W.MORROW
Editor

Congress faces facts

WILL Congress rise to the occasion or will it play politics in a pre-election year? No doubt exists that prevailing national conditions call for statesmanship of the highest order. The nation is confronted by unemployment, an increasing national deficit, the need for stabilization of industry, questions of taxation, armaments and banking and many other major problems that are non-partisan and non-political. The people are in a serious mood and desire action. It is to be hoped that Congress will respond to the popular demand. If it does not, there is certain to be a day of reckoning in this country, as there was in Great Britain and as there always is in a democracy when public sentiment is actually aroused.

The most definite thing that Congress can and should do is to face the national deficit and devise equitable taxes and other means to meet the situation. This cloud is most disturbing to business, to credit conditions and to those contemplating expansion in industry. The least definite thing would be an attempt by Congress to enter business or to attempt to solve the problems of business. Lawmakers can create legislation whereby business can act to better advantage, but they cannot make business stability. It is to be hoped that leaders in both agriculture and railroading will recover courage and that the examples that these industries have supplied of business leaning upon government will not lead other industries to take the same road to destruction or convince Congress that it should follow this path on its own initiative. Business must work out its own salvation in the environment it creates.

So far as the electrical industry is concerned no legislation by Congress is expected. A possible modification of anti-trust laws so that manufacturers can act more intelligently and a settlement of the taxation situation would be constructive steps applying to the electrical as to all other industries. Nor is there anticipation of any destructive legislation. The froth and foam associated with radical attacks on the "power trust" has no place in serious counsels for national betterment.

The new Congress has the best wishes of the nation, which will keep it under close and judicial observation. It will receive public support in the degree that it merits by wise action in this critical period in national affairs.

Dry streams and dry statistics

PROLONGED drought, resulting in abnormally diminished stream flow, brings a chain of consequences that merit especial consideration during a period like the present. Returns on electrical output are being scrutinized with lively interest by economists and business leaders as indicative of industrial activity. Power-company facilities are under review for economies in investments and operation.

Kilowatt-hour data are liable to be misconstrued unless interpreted in the light of technical knowledge. For example, lack of water power throws a relatively larger load on the steam plants. The latter are usually close to load centers, while hydro-electric energy often comes over long transmission lines, with considerable loss. A given load carried on steam therefore calls for the generation of appreciably less energy than if carried on water, and the greater the losses the greater the difference. Thus the 5 per cent reduction in output in the Pacific States in September

and 7 per cent in October, compared with 1930, may represent little reduction in consumption. Similar reasoning applies to other water-power sections.

These considerations are pertinent in view of the fact, pointed out by the Geological Survey, that only 26 per cent of the country's production in October came from water power—the smallest fraction since the survey's records were begun in 1919.

There has been talk about overbuilding. Inevitably there will be excess capacity in an industry that is under public obligation to plan long ahead when in two consecutive years energy consumption decreases. But it would be interesting to know in how many localities a "power famine" has been averted, notwithstanding lessened industrial activity in the country as a whole, by the existence of steam capacity that with normal stream flow would have been superfluous.

A big hydro-electric plant counts as so many kilowatts in a census, but of what avail is it when there is no water? And what would have been the effect on the public if inadequacy of power had been added to our other plagues? Financiers and others who undertake to judge the industry on the basis of statistics alone, without an adequate understanding of its functioning, might well ponder these things.

Make use of the technical man

NOW as never before industry has the opportunity to use the brains of technically trained men and to profit by such use. A case in point: A process industry in the Chicago district several months ago found that it had no work for twenty young engineers on its staff. They were the newcomers, logically the first to be laid off. But instead of turning them loose the chief engineer called them into his office and put a sporting proposition before them. He said: "The twenty of you are costing the company $4,000 a month. There is no work now or immediately in sight for you. Rather than give you each a month's notice to hunt for new jobs that probably you won't find, I am going to give you a two months' chance to see what you can do right here. Go out into the plant and check up everything in sight. See if you can't stop wastes or change methods so as to save the $4,000 a month the company is paying you."

The twenty went through that plant with the thoroughness of grasshoppers in a wheat field. They found many things whose correction in sum total of economy equaled their salaries. In addition, and of spectacular significance, they discovered a means to reduce the use of process steam from eight to three pounds per unit of product at a saving of $25,000 per month.

Co-operation today in the electrical industry

PRESENTATION last week in Poughkeepsie of the James H. McGraw medal for co-operation to Thaddeus R. Beal, president of the Central Hudson Gas & Electric Corporation, gives emphasis to the changing character of co-operation in the electrical industry today. The honor was awarded by a committee of judges representative of the several branches of the industry, in recognition of the successful system of practical co-ordination which has been developed in the Hudson Valley in the local activities of electrical men.

It is a fair statement that national co-operation is at a low ebb right now in the electrical industry. But more serious effort is being applied to the improvement of local relations than ever before. And the reason is that the inevitable early talking phase of co-operation seems to be crystallizing into a working phase, which has come naturally out of the stresses of readjustment that have followed the end of pioneering conditions.

Electrical men have long been proud to call themselves co-operators. But it has not been essentially true. They were pioneering a great new contribution to human welfare and happiness and it thrilled them. They were carried forward by an onsweeping market, singularly free from the restrictions of competition. Fired by the enthusiasms of their success, they were uplifted by a dream, intoxicated with an ideal. They were brought into a close relationship by the enjoyment of a common prosperity, and they called it co-operation. But it was mostly take and little give.

The test came when the era of line extensions into new territories and large-scale house-wiring campaigns drew to a close. It brought radical changes not only in the operations but in the

economies and the human relations of the entire industry. For electrical manufacturers, wholesalers, contractors, dealers and power-company men who from the beginning of their history had prospered by the accumulation of customers suddenly found themselves in a new situation where they were dependent for further progress on competitive selling directed to the development of more business from existing customers.

All five branches of the industry were involved in all these interrelationships. To make the inescapable readjustments needed to meet the new conditions called for reforms in policy and practice. No one group was immediately willing to make apparent sacrifices to aid the other. There was much complaint and controversy, and the old spirit of co-operation in national affairs of the industry began to wane. The last few years have seen much acrimony and little accomplishment in the relations between the groups.

Out of the welter of all this misunderstanding and impatience is now emerging a recognition that the basis of real co-operation must rest in common-sense relationships between electrical men in their local work. The public expects but one thing from the electrical industry—power and equipment to use it with. To make this possible the five parts of the electrical industry in each community must work together. The pressure of events has already compelled electrical men in some of these localities to forget selfishness and to see that co-operation means friendly policies in action—not just words. And the Hudson Valley offers perhaps the most outstanding example of how this policy may be organized into a practical program.

The fact that in the Central Hudson system the utility does not itself merchandise domestic appliances has no significance in this award. The judges were impressed with the fact that in this group of communities electrical men have worked out in their own way a basis of co-operation that is successful both in the judgment of all groups and in the record of its accomplishment. Appliances are retailed through dealers' stores, but the power company is deeper in the merchandising activities of the local industry than ever before. This is a detail. The important point is that Mr. Beal's company has gone to work deliberately to make co-operation profitable to every other branch of the industry and to the public—and in the process it is proving eminently profitable to the utility. This is the contribution that won the award.

New pole standards facilitate economic utilization

WOODEN-POLE specifications have been in an unco-ordinated state for many years, but new standards recently promulgated by the American Standards Association greatly clarify the situation along sound lines.

Every tree that is of pole caliber should be able to find its economic place in some overhead line. Consideration of terrain and loading require first of all that poles be classified according to length and size. In the new specifications, poles of the same class are of equal strength regardless of their length. Furthermore, poles of the same class but of different species are of such sizes as to be appropriate for the same loading. Finally, the several classes are graduated with intervals in geometric progression on the preferred-number principle, so that a limited number of classes will adequately serve all requirements.

Previously the situation was badly confused. Western red cedar, for example, was specified differently by four of the major utility groups. As a consequence production and supply were hit or miss, and no contribution was made to conservation of the standing supply or to economy in use. Worst than that even, there was a tendency to regard the old letter classification for all poles as a direct index of the quality of the timber. The new specifications separate the concepts of quality and of strength into two distinct subdivisions.

Each species has its own inherent idiosyncrasies as to shape, latitude of variations and predisposition to structural defects, disease and damage from insects. Specifications define these aspects more logically than before. They should greatly improve the intelligent economic use of the run of the woods and, above all, remove those large uncertainties which have prevented a direct comparison of usefulness and price of timbers of different species and origin. R. L. Jones and his sectional committee have done a meritorious job, the results of which will reflect true economic value as rapidly as their significance is sensed.

Water Power in Its Economic Aspects*

By GEO. A. ORROK
Orrok, Myers & Shoudy, Consulting Engineers, New York

THE subject of economics is still in the controversial stage, and perhaps no other division of this department of science has been troubled by so many popular misconceptions and fallacies in the minds of otherwise well-informed people as has been the case with the power industry. These misconceptions exist not alone in the popular mind but are held by some of our leaders of political and economic thought, and even by some technically trained engineers who have not been in close contact with the development and use of power.

Such statements as these are found in the public press, in reviews and magazines, in political speeches and in the halls of Congress:

"Water power is a free gift from God." "Power which nature has supplied us through the gift of God." "What is the raw material of this monopoly? It is the rivers and the brooks that flow from the mountains to the sea." "Every rippling stream which trickles down the mountain side and flows through the meadows to the sea is capable of producing this unseen and little understood element which man has called electricity."

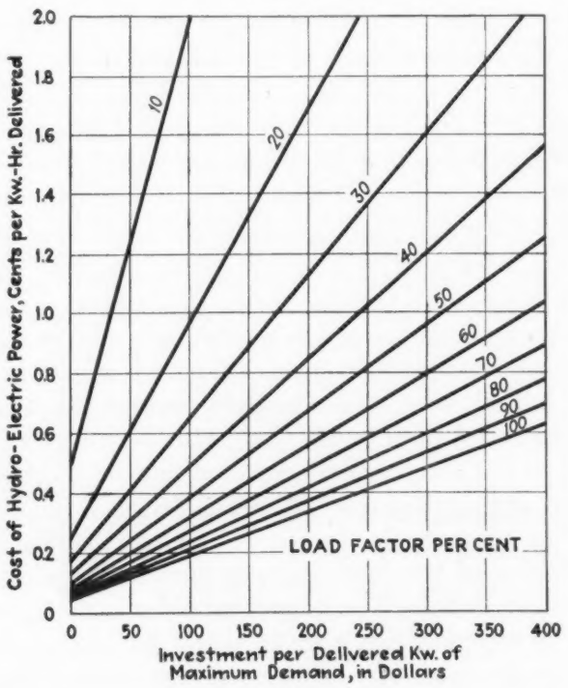
Let us examine the facts in the case.

Water power is not free—Niagara Falls, as one of the cheapest of undeveloped hydraulic power sites, would cost about $200 per kilowatt to develop, which the transmission to the market and losses would increase to perhaps $300 per kilowatt. Nature supplies the falling water, but some one must pay the cost of harnessing the water, converting it into power and transmitting it to the market where it can be used. Very few "rippling streams" have enough water flowing or sufficient fall to warrant the expenditure of the large amount of capital required to develop and deliver to the market such power as may be generated. In general, water power is a rather speculative investment, so much so that the investor usually demands a higher rate of return than he would on a usual business investment.

Water power is not abundant—We know, for instance, that the average annual rainfall over the whole 2,985,650 square miles of land and water surface of continental United States is not far from 30 in. per year, equivalent to a rainfall of 6.6×10^6 cu.ft. of water per second. We also know that the average elevation of the surface of the United States above the sea level is about 2,230 ft. Assuming all the water to be used and all the fall, the kilowatts corresponding to this flow and fall at 80 per cent efficiency of apparatus would be $1,000 \times 10^6$ kw.

But we know that all the water cannot be utilized. Drinking water, vegetation and evaporation, ground water storage and chemical combination utilize a large portion of the water supply, reducing the average run-off to perhaps 35 per cent of the rainfall. Our figures for the average height and average rainfall do not take into account the distribution of the high areas and the low areas, and as a matter of fact certain low-lying areas along the Gulf of Mexico, where the elevation does not exceed 200 to 300 ft. above the sea level, have an excessive rainfall, while other areas, such as the great interior basin, at an average level of about 6,000 ft., receives a very meager rainfall, amounting to from 3 to 7 in. per year. When a weighted rainfall versus height above sea level is calculated, the correction factor would be of the order of 64 per cent.

Another point which must be taken into consideration is the fact that rivers like the Mississippi, the Colorado and a good many of the Southern rivers have a large alluvial plain extending back into the country many hundreds of miles. Here the slope of the water surface is of the order of 6 to 8 in. per mile, while it is nearly impossible to utilize for power purposes falls much smaller than 10 ft. to the mile. Other factors, such as flood flow,



Hydro-generation costs as affected by load factor and investment charges

**Excerpts from "The Economics of Water Power vs. Steam Power," as presented by Mr. Orrok at the third International Conference on Bituminous Coal, Pittsburgh, Pa.*

foundations on alluvial plains and pervious geological formations, make large stretches of medium fall unavailable. It is only in very rare cases that anything like the total flow of the stream can be used for power generation. We may take 60 per cent for this correction factor.

We must introduce here an additional factor which covers the distribution of the rainfall through the various months of the year and which would vary from 20 per cent on certain of our Western rivers, particularly those of the Pacific Slope, to as high as 85 per cent on certain of our canalized Eastern rivers, or perhaps 90 per cent in the case of Niagara. What will be the average over the United States is not definitely known, but it is reasonable to take a factor of 50 per cent as covering this use of water.

If we now multiply our factors of 35 per cent $\times$ 64 per cent $\times$ 60 per cent $\times$ 50 per cent, we will get a figure of, roughly, 6.7 per cent as the utilization figure; $1{,}000 \times 10^6$ kw. for 8,760 hours would yield 8.76×10^{12} kw.-hr. at 80 per cent efficiency, which being multiplied by 0.067 gives 586×10^9 kw.-hr. as the maximum output to be expected if all the run-off of the United States could be utilized. This output if generated by steam at 1.67 lb. per kilowatt-hour, the average central-station rate of 1930, would require 437×10^6 tons of coal; about 73 per cent of the annual coal used in the United States.

This estimate is liberal; indeed, former estimates previously made are lower and the only authoritative estimate, that of the Geological Survey, is less than one-third as large.

The estimates of the Geological Survey have been made on a slightly different basis and only include sites where the estimated cost did not exceed $500 to $600 per kilowatt. Their estimates are:

20,700,000 kw.	90 per cent of the time	163,000,000,000 kw.-hr.
32,800,000 kw.	50 per cent of the time	144,000,000,000 kw.-hr.

or, in round numbers, 160,000,000,000 kw.-hr., equivalent to 120,000,000 tons of coal at the 1930 rate of 1.67 lb. per kilowatt-hour.

The Geological Survey reports as of January 1, 1931, a hydraulic installation of 8,799,000 kw., which should yield something between 71,000,000,000 kw.-hr. and 38,500,000,000 kw.-hr. at the above ratio. On this installation we actually generated in 1930 about 33,000,000,000 kw.-hr. Using this ratio and the Survey's estimate of all possible plants irrespective of cost

we may expect roughly 123,000,000,000 kw.-hr. per year as the maximum possible output from water power in the United States at a cost three to four times larger than the equivalent output of steam power.

We already use the equivalent of twice this figure in mechanical power generated by steam in this country and our central station and industrial power amounted to about this same figure of 123,000,000,000 kw.-hr. in 1928. Hydraulic power has been running from 40 to 33 per cent of the central-station power and this proportion will become smaller as the newer developments become more costly and further away from markets.

Hydraulic developments are not cheap—In the early years of our country the small water-power plants cost from $70 to $100 per equivalent kilowatt. This cost has

Water power is not free.
Water power is not abundant.
Water power is not cheap.
The maximum possible output of water power in this country would cost three or four times more than the equivalent steam power.

been increasing and in 1900 the average cost had risen to $150 per kilowatt. In 1920 the actual figures ranged from $200 to $250 per kilowatt, while today the average of all undeveloped sites has been variously estimated as running from $300 to $600 per kilowatt. This cost includes the real estate and water rights, the dam, head and tail races and power station buildings with the gates, valves and screens, the penstocks and surge tanks, turbines, generators, governors and switchboard. As additional costs we must include step-up and step-down transformers, rights-of-way and transmission lines and the substations with transformers, condensers, and switching apparatus to the market, which may easily add $100 per kilowatt to the above figures.

Fixed charges on cost make up a large portion of the total cost of hydro-electric energy, the operating cost being small. These operating costs average about $2.60 per kilowatt per year, while the transmission operating costs run about $2 per kilowatt per year. Fixed charges are variously reckoned from 9 to 15 per cent, say 6 per cent interest, 4 per cent depreciation, 4 per cent taxes, 1 per cent insurance, but for my calculations I use 12.5 per cent as a fair average. The kilowatt-hour charge will then depend on the flow of the stream and how carefully the flow, pondage and storage can be adjusted to the demand. In any event, the output is a function of the runoff, which varies almost 50 per cent from year to year. I know of one hydro plant where the output has varied from 97,000,000 kw.-hr. in a good water year to

Costs for Steam Generation of Electrical Energy

Five Units (One in Reserve)

Fixed charges, 12.5 per cent. Cost per kilowatt complete, $100

Yearly fixed charges, $1.2 \times 12.5 = \$15$. B.t.u./kw.-hr. $= 13{,}000 + \frac{100{,}000}{LF}$

coal (14,000 B.t.u.) $= 0.929 + \frac{7.15}{LF}$.

Load factor, per cent	100	80	60	40	30	20	10
Hours' utilization	8,760	7,008	5,256	3,504	2,628	1,752	876
Fixed charges per kilowatt-hour, cents	0.171	0.212	0.285	0.428	0.571	0.856	0.713
Other charges, cents	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Total except fuel	0.251	0.292	0.365	0.508	0.651	0.936	1.793
Pounds fuel per kilowatt-hour	1.000	1.018	1.048	1.108	1.167	1.287	1.644
Total cost, cents per kilowatt-hour:							
Coal $1 per ton*	0.296	0.338	0.412	0.557	0.703	0.993	1.866
Coal $2 per ton	0.340	0.384	0.458	0.607	0.755	1.055	1.940
Coal $3 per ton	0.385	0.428	0.505	0.656	0.807	1.108	2.013
Coal $4 per ton	0.430	0.474	0.552	0.706	0.859	1.166	2.087
Coal $5 per ton	0.474	0.519	0.599	0.755	0.911	1.223	2.160
Coal $6 per ton	0.519	0.564	0.645	0.804	0.963	1.280	2.233
Coal $8 per ton	0.608	0.656	0.739	0.904	1.067	1.396	2.381
Coal $10 per ton	0.697	0.746	0.833	1.002	1.171	1.510	2.527

*Ton = 2,240 lb

as low as 43,000,000 kw.-hr. in a very dry year, the cost being substantially constant and practically all the water being used. In the dry year the unit cost was more than twice the cost in the wet year.

In the accompanying figure showing the unit cost of hydro-electric power it will be noted that the fixed charges make up somewhere between 90 and 95 per cent of the cost of water power, and as the prime cost of development has been increasing and will continue to increase the unit cost of hydro power has been continually advancing. These costs do not include any profit which should be added if the true economic condition is to be ascertained.

Steam power in the United States has been increasing very rapidly. The figures, if we leave out the agricultural, locomotive and marine uses, are large indeed:

	Kw.
Central stations	24,206,000
Industrial	15,000,000
Mining and other	9,000,000
Total	48,206,000

The output has been roughly 125,000,000,000 kw., giving a load factor just below 30 per cent. The equivalent fuel burned will be about 218,000,000 tons, roughly 36 per cent of our fuel output. It should be noted that while the central-station output is growing, the industrial use has not increased, and, if anything, is becoming smaller. The coal consumption per kilowatt-hour in the central station, averaging 3.2 lb. of coal per kilowatt-hour in 1919, is now reported in 1930 at 1.67 lb. per kilowatt-hour. The kilowatt-hour coal consumption of the industrial plants has been estimated at around 6 lb. per kilowatt-hour on the average.

In the central-station field many of the newer and better plants are producing electricity at about 1 lb. of coal per kilowatt-hour, while the best plants use only 12,500 B.t.u.'s, about 0.9 lb. of coal per kilowatt-hour. We may confidently expect thermal efficiencies as low as 11,000 B.t.u.'s per kilowatt-hour in the near future on a base load plant with a high load factor. Commercial efficiencies depend on cheap fuel, low construction cost and good load factor and the total cost, fixed and operating, in many steam plants is as low as 5 mills, while the best reported cost is below 3 mills per kilowatt-hour, equivalent to a cost on the same load factor of $168 per kilowatt of delivered demand in a hydro plant.

While the cost of a water-power installation varies widely with the local conditions and distance from a market, the costs of steam power are much better understood and much less variable, but even here the effect of load factor on cost is quite marked, although fixed charges do not usually amount to more than 45 per cent of the total cost. English authorities divide the cost of steam power into fixed charges, 45 per cent; fuel, 45 per cent, and other charges, 10 per cent, and this perhaps may be taken within limits as a true statement. The costs of steam stations in this country has varied quite widely. Records from more than 100 stations built in this country average about $100 per kilowatt. When taken by ten-year periods, the averages are practically $100 per kilowatt, although during the last 40 years stations have been built as cheap as $50 per kilowatt and some stations have been reported to cost more than $200 a kilowatt. Modern stations, within the last few years, have been running from about $115 to as low as $70 a kilowatt, but for purposes of comparison we may take the average cost as $100 per kilowatt. I am figuring, in this comparison, the fixed charges at 12.5 per cent, as with the hydraulic plants, but I am considering a 20 per cent reserve which is not included in the hydraulic diagram.

Further economies are in sight with the use of higher pressures and temperatures, while the mercury-vapor and other binary vapor plants promise even better economies. Thus the steam plant is not yet approaching its ultimate efficiency. Hydro plants, on the other hand, are very near the ultimate efficiency, 92 to 94 per cent, leaving very little chance for improvement.

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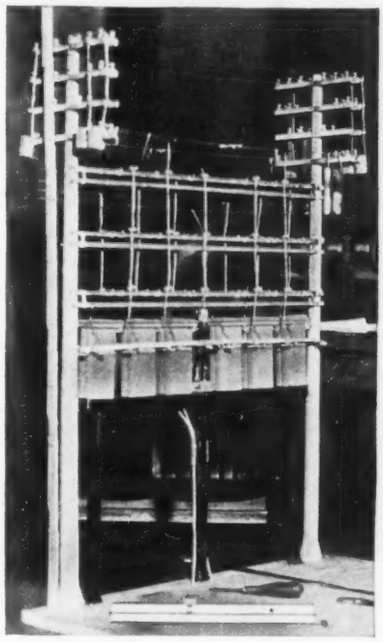
Synchronous Condenser Installed for $10.20 per Kva.

A Massachusetts company installed a 7,500-kva. synchronous condenser with 7,500-kva., three-phase transformer, air cooler, switchboard, wiring and miscellaneous equipment for $76,314, according to a recent tabulation of construction costs. The unit operates through the step-down transformer, which is connected with a 22-kv. bus in an existing station. Major cost items were as follows:

One 7,500-kva., 8-pole, 900-4,000-volt synchronous condenser with exciter and accessories	$17,750
One two-section surface air cooler	2,362
Switchboard	7,605
One 7,500-kva., three-phase transformer 22.8-kv. primary	15,145
Transformer track, condenser foundations, etc., installed	6,791
Labor	12,385
Services, consulting engineers	1,429
Miscellaneous engineering services anc supervision	4,235
Interest during construction	619
Taxes during construction	429
Miscellaneous supplies and equipment	7,564
Total	$76,314

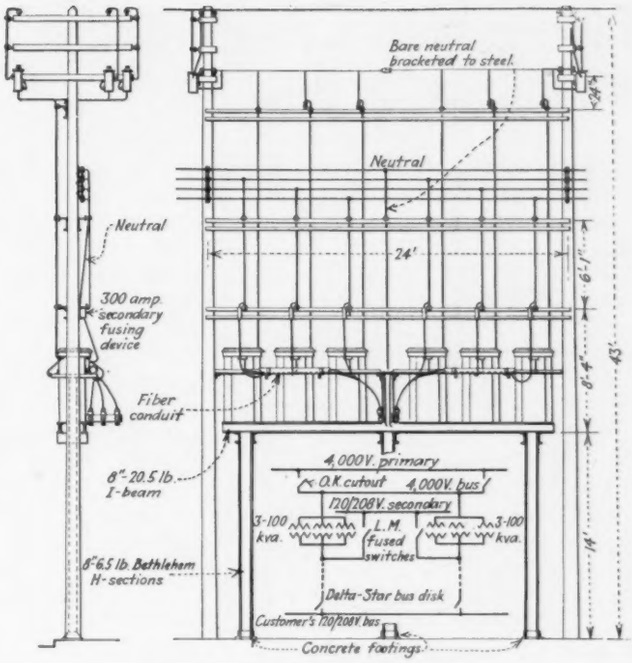
Economy and Flexibility in an Overhead Substation

Compact, easy to increase capacity for load growth and safe to work on is this overhead type substation recently designed and erected by the Louisville Gas & Electric Company, according to W. D. Roach of the company. The size of the load demanded a transformer capacity of 600 kw. with a limited amount of space for installing. It was decided to install two banks of three 100-kw. transformers, operating normally in parallel and with adequate switching facilities to carry the breakdown load on one bank. Ordinarily a double bank of this type would be installed on a three-pole "rack," the transformers supported on 10-in. channels bolted to the poles. However, anticipating a future load of double the present capacity, this plan could not be considered since such a structure would not be safe to carry the weight of six 200-kw. transformers. The only solution was a steel platform built after preliminary erection and study of a model design. The saving in dollars and cents may be only roughly estimated on a job of this type, but finally "we have designed a substation which we definitely know is safe, economical, adaptable to expansion, efficient and which very definitely is not a 'cut-and-try' proposition and which will not necessitate expensive changes after erection."



First, the model

This miniature design greatly facilitated the planning of the substation. It showed with obvious clearness the answers to all questions of clearances and safety.



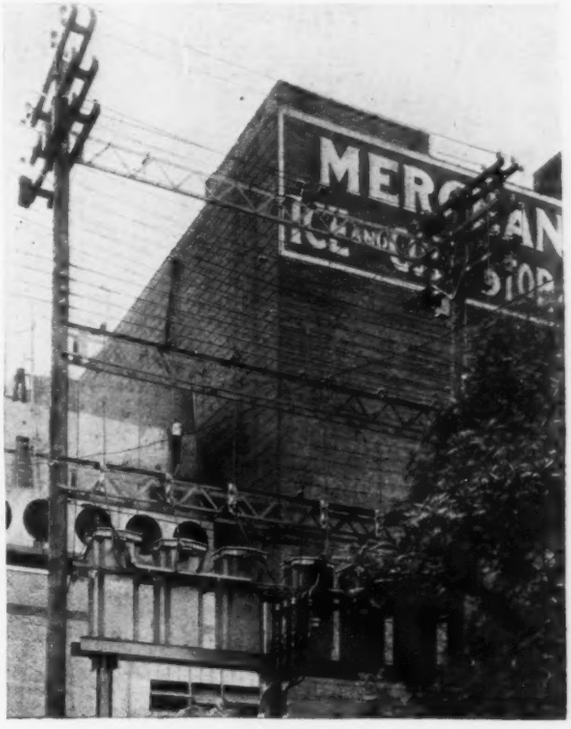
Structural and electrical design

Steel members are figured with a safety factor of ten under present loading. This will permit the use of heavier transformers later. The cross-members between the poles are trusses of 2x2x¼-in. angles laced with 3x⅜-in. straps.

List of Material

2 50-ft. poles	6 5,000,000-circ.mil lugs
12 8-ft. crossarms complete	24 Locust pins
6 Mathews O.K. cutouts	12 Pierce pins
6 L. M. open-type fused switches	41 No. 4400 Clamp pins; No. 161 clamps
5 Special steel trusses	4 4-in. pipe straps
1 Special steel transformer platform (B)	12 Space blocks
3 Reinforced concrete footings	12 Angle brackets
6 No. 5 150, G&W potheads (500,000-circ.mil)	40 ¾-in.x1-in. machine bolts
2 four-way secondary racks	36 ⅝-in. through bolts
6 100-kva., 2,300/120-208-volt transformer	6 ¾x4½-in. lag bolts
64 ft. 3-in.x3-ft.x⅜-in. angles	250 ft. 4 W.D. wire
10 ft. 4-in. fiber duct	100 ft. No. 4/0 W.P. wire
77 No. 60 insulators	75 ft. 500,000-circ.mil W.D. wire
3 No. 506 insulators	40 ft. No. 4/0 bale standard wire

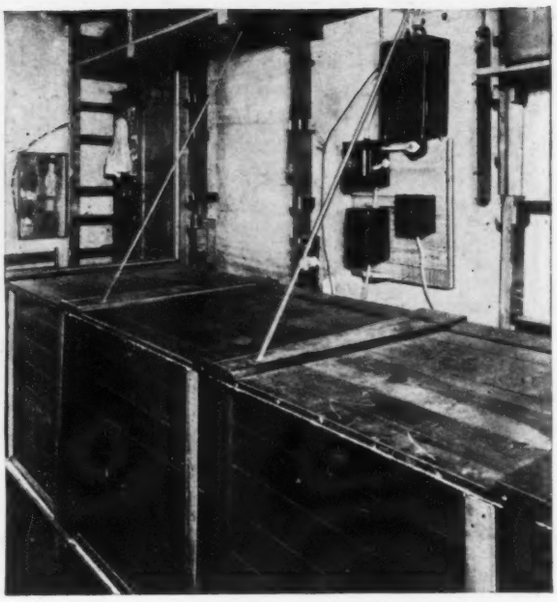
The single-conductor potheads for the two customer service cables are supported on channels bolted inside the flanges of the middle H column, which extends above the supporting beams for the transformers. Additional secondary service is carried up on the steel trusses and feeds other installations on the same street. This secondary is paralleled on the substation through sectionalizing fuse switches. The primary bus is sectionalized so that either bank may be fed independently of the other, in emergency.



The finished job

Electric Heat Cuts Processing from Days to Hours

A reduction in drying time from two days under former steam heating conditions to from sixteen to eighteen hours with electric heat has been achieved by the Mason Brush Works, Worcester, Mass., at an over-all cost which will probably not exceed $150 when the complete insulation of the drying compartment has been effected. The company manufactures, among other products, a varied line of industrial brushes, including types used in the paper-making and leather industries. One of these types is a rotary brush of Oriental pig bristles of high quality mounted in aluminum holders on a steel shaft, ranging in length from 6 to 8 ft. and in diameter from 12 to 18 in. In fastening the brushes to the shaft it is necessary to hold the bristles under heavy mechanical pressure and to set them in a special cement which must be baked to brittle hardness at from 185 to 200 deg. F. With low-pressure steam heat it was difficult to obtain satisfactory temperatures, and in summer the arrangement was inconvenient and expensive as it was necessary to operate a steam boiler for this purpose alone. The drying box was located in a basement and had to be served by an elevator at considerable delay.

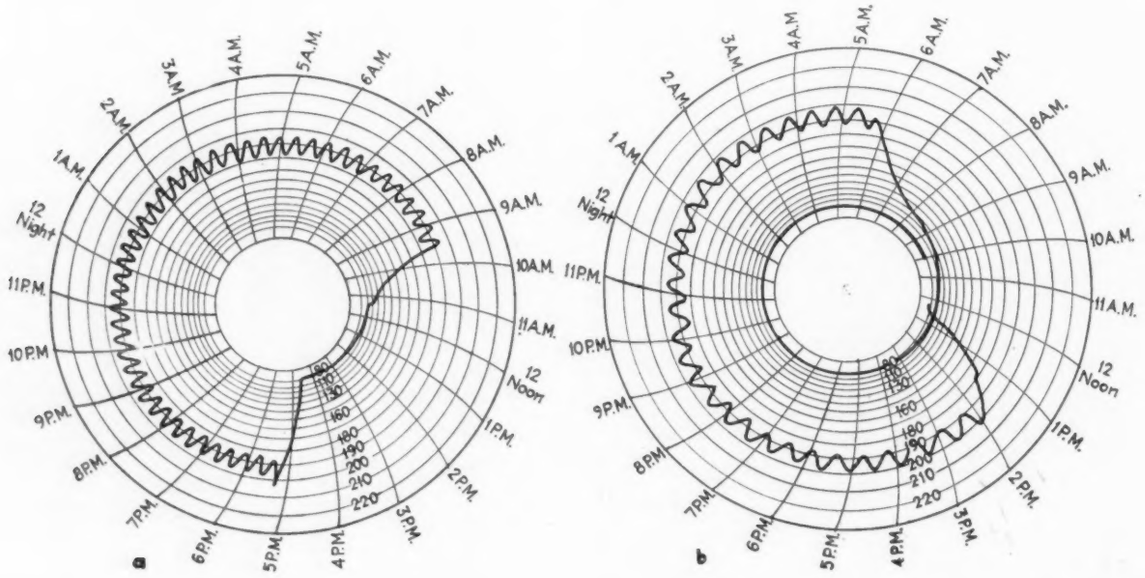


Drying box for industrial brush processing requires automatic temperature control between 185 and 200 deg. F.

The Mason company took up the problem of utilizing electric heat for this work with the industrial department of the Worcester Electric Light Company. The drying box was equipped with six 750-watt, 110-volt flat space heaters arranged in series-parallel pairs to operate from a 220-volt, single-phase circuit. The drying box, of 1-in. pine board, 12 ft. long x 4 ft. high x 3 ft. wide, was lined with asbestos and equipped with an automatic thermostat and switch. Later three $\frac{1}{16}$-in. sheet-iron plates were mounted 5 in. and 7 in. above the floor in staggered relation to improve the heat distribution, and shortly $\frac{7}{8}$ in. of outside insulation will be added. The drying time for bristles when wet has been reduced and the cement drying time cut as stated, the work usually being placed in the box in the early afternoon and dried continuously until forenoon. The energy cost of drying is now about 50 cents per brush, and the speeding up of the production is of course most important. Uniform results are obtained, and the drying box has been relocated on the main floor of the shop convenient to the working departments. The adaptation of space heaters and other available standard equipment to the insulation and wiring of the box kept the cost low.

Records show process control

(a) Steady night load is provided by drying process. Before steel baffle plates were installed, the energy supply was cut in three times per hour.
(b) Typical temperature chart for drying run after baffle plates were installed, cutting energy inputs to two per hour. The process does not require closer heat regulation than shown, and this contributed toward lower first cost.



Valuation Squabbles and Inadequate Staffs Thwart Regulation*

By WILLIAM L. RANSOM
Whitman, Ransom, Coulson & Goetz, New York, N. Y.

"Regulation with a smile" better than regulation warfare.

Neither prudent investment nor reproduction need dominate rate thinking.

Purposeful regulation demands well-paid, competent staffs.

MANY persons who advocated a "prudent investment" base as a great moral and economic issue appear to have lost interest in it; now they think that present replacement costs have in many instances dropped, or may drop, below investment costs. In a period when prices as well as wages rose far above the pre-war level, the "original cost" doctrine was looked upon as a means to an end, the most effective weapon which could be wielded for lower rates. When doubt arises whether the investment concept would assuredly lend itself to such a result the enthusiasm once manifested for it has become less vocal. By the same token, some spokesmen for utility companies, who long looked upon the constitutional protection of a return upon "present value" as the "last-ditch" defense against compulsory rate reductions that are deemed to go too far, do not find themselves nearly so sure that in the event of an inescapable conflict over rates they need so much to rely upon valuation at present costs of materials and labor. Furthermore, the extension of commission supervision of utility accounts and the full reporting of the results thereof during the recent investigations by the Federal Trade Commission have confirmed that gas and electric rates have commonly yielded less than a standard rate of return upon either present value or investment, and in the instances where the rates came to yield a return in excess of 7½ or 8 per cent upon the investment the commissions have usually been active in demanding reductions. There are plenty of instances in which the commissions have demanded and obtained large reductions in rates already yielding less than 7 per cent upon the investment as well as less than 7 per cent upon present value.

It has become fairly evident that, alike under the rule successfully urged upon the Supreme Court by Mr. Bryan in *Smythe vs. Ames*, or under any other rule or yardstick of valuation and return, state regulation of rates can be and is being made effective in states which are willing to create able commissions with adequate appropriations and staffs. In other states state regulation of rates does not function effectively, in spite of commission adherence to the "minority" doctrine of "prudent investment" as the "rate base." In many states extensive rate reductions are being brought about by the commissions and rates are being kept reasonable, with no serious obstacles interposed by judicial decisions on valuation. The claim that the "present-value" concept makes rate litigation hopelessly protracted has repeatedly been refuted in recent months and years. Some of the most "protracted" cases have been tried only on the "prudent investment" theory, and rate hearings have been found to last many months, even when all questions of valuation, property and return have been excluded therefrom. The thing which takes time, essentially, is not valuation as such or ascertainment of investment as such, but dealing with rates by litigation and hearings. It takes time and costs money to deal with anything by litigation; complex business situations and questions do not lend themselves readily to prompt solution by litigation; public utility rates go along with the rule and are no exception. The factors which tend especially to prolong rate litigation, when it is resorted to, cannot be attributed primarily to valuations. Inability or unwillingness of municipal authorities to co-operate in the expeditious presentation of these cases has often been found to be far more responsible for delays than any necessity of conforming to "the law of the land" in methods of proof.

People are thinking of other things than utility valuations

On the one hand, we have a radical or revolutionary attitude, which in its most violent forms is flaming "red" and in its milder forms seems to be a revival of the Granger movement and a later Populism. The adherents of this school have stopped bothering themselves whether the return is to be figured on "present value" or "prudent investment"; they are opposed to any return or net earnings at all. All net earnings and even all increase in gross revenues have been denounced by high authority as "profits" extorted from the people.

**Excerpts from address before American Academy of Political and Social Science, Philadelphia.*

"Reduce first and investigate afterward, if at all," is the demand. To save money for great numbers of voters is too alluring to be retarded by search for facts.

The Governor of one of the states west of the Mississippi recently importuned many of his fellow Governors, by letter, to join him in starting a simultaneous campaign, in each state, against one of the national utilities, by every manner of proceeding in court and before the commissions, for forfeiture of charters, annulment of franchises, increases in assessments and taxes, and every manner of litigation and legislation. For what purpose did he ask that all this be done? To depress the market value of the company's stock. 'And for that purpose did he propose to destroy the value of investments made by individuals all over the world? To destroy confidence in present executives of the company and compel reductions in rates in each state. Was it suggested at all that each state should investigate and find out whether rate reductions were warranted by the facts, or whether any of the proposed litigation was warranted by the facts? No such considerations were mentioned; rate reductions irrespective of the facts are demanded.

No theory of valuation or the "rate base" would protect the public interest, if intrusted to a mediocre commission without competent personnel. I have never seen any theory of valuation curb or impair the work of a vigilant commission which has assembled an alert, fair-minded and experienced staff.

One of the most regrettable features of the situation has been and is that men in conspicuous position, men ambitious for political advancement or newspaper notice, men whose abilities and attainments charge them with the duty of being fair and responsible in their public statements, nevertheless say things calculated to fan and foster popular misunderstanding and resentment as to the utilities. Weight is attached to such declarations, because of the prominence of their authors. The average man and woman can hardly be blamed for misinformation and prejudice as to public utility matters, when matters of this character are so irresponsibly broadcast by men who know better, but who do not hesitate to make wild and wanton assertions as to other people's investments, in the eager hope that such appeals to popularity will yield political returns.

There is, however, a constructive side

Side by side with all this, a great deal is taking place which gives ground for confidence in the soundness of the very institutions attacked. In contrast to this atmosphere of denunciation and misunderstanding there stands out sharply the increasing number of regulatory commissioners and utility executives who, in an open-minded, flexible and constructive way, are trying to move ahead and accomplish fair and practicable results, step by step, along lines which promote the long-run public interest. In a large number of states this manner of public regulation was never as active and as effective as at the present time. Results are accomplished smoothly and promptly, with administrative ascertainment of the facts, often around a conference table—regulation with a smile, but a smile that does not lack teeth. Large-scale results are brought about, for public benefit and advantage. Naturally, in such a constructive and co-operative program, there is no need, and little place, for violent controversy about "valuation" or anything else which belongs in the arena of warfare rather than adjustment.

The fact is that the American public needs and wishes, more than anything else from the utilities, the best possible service at the lowest practicable rates and under the forms of rates best adapted to the public needs and uses. It is the paramount task of utility executives to achieve these objectives, and the like task of regulatory commissioners and their technical staffs to insist upon results along these lines. Rates must be and will be kept such, in forms as well as amounts, as will enable the extensive use of each utility service for every purpose for which it is economically suited. Rates and rate forms must be kept abreast of the great strides made by utility engineering. These are present-day constructive tasks which have little in common with valuation controversy.

This valuation question belongs in the arena of warfare rather than accomplishment. It is a weapon of litigation, and litigation is the alternative of adjustment.

No modern business could be carried on chiefly through litigation, and this is true alike of the utility business and of the regulation of utilities.

Sometimes litigation is inevitable, and then valuation may be inevitable. Divergencies of views and interests sometimes cannot be settled, even with all the facts disclosed. Valuation is a weapon in the hands of the commission to compel proper reductions which have been refused. Valuation is a weapon in the hands of the utility to defend against improper reductions which have been demanded. But modern business is not carried on with weapons; resort to them in emergency interrupts the regular course of accomplishment.

Valuation is a method approved by the highest court for determining how far regulation may go in forcing its mandates upon a utility, in a matter as to which conference and administrative action have failed.

There is nothing in the present-value concept which forbids the allowance of rates which yield a fair return upon at least the full investment. Even when the price level recedes, the allowance of such a return will continue to rest in the discretion of those who now are contending that a return upon at least the investment should never be denied. When present value exceeds investment, as is generally the case today, it is for the utility executives to say, as the facts hereinafter reviewed show that they are saying, whether, in the exercise of business judgment, their whole rate structure should be such as to yield a fair return on less than present value. When the investment exceeds the present value, as may some day come about, it will be for the regulatory authorities to say, in the exercise of good judgment and fair play, and taking into account the rate history and policy of the company, whether the company should be permitted, unless other economic factors intervene, to charge rates yielding a fair return upon the investment rather than the present value.

Here may be found a formula of fair play and mutual

consideration which may satisfy those who profess the most anxiety that they should never be compelled to force rates below a fair return on the investment. If we look upon the whole matter in a clear light and with accurate terminology, and if the utility companies are reasonable and conservative in their rate-making practices, is there anything really irreconcilable in the present divergencies which are so disturbing to many thinkers on utility subjects?

The complaint once heard so insistently as to valuation and appraisal methods came largely from those who thought valuation did not lend itself to their efforts to force rates below constitutional limits. They may now resort to new sophistries. Twice during the past few weeks I have heard gentlemen who were conspicuous advocates of original cost as the "rate base" start out with such cost (fixed capital) and then diminish it by substantial percentages to reflect their view of the effect of the change in prices. I understand that from this platform a distinguished advocate of original cost as the "rate base" has declared that rates are really based on "original cost" if they are now based upon such cost diminished by a percentage to reflect the lowered prices! All of these gentlemen stoutly resisted for years any suggestion that changes in the price level could ever raise the "rate base" above original cost. They are reconciled to "present value" when it is lower.

I do not believe that an important rule of law and economics can be controlled, on an opportunist basis, by the incident that replacement costs are above or below original cost. The further fact remains that in the large majority of cases results are secured with reasonable promptness, without the necessity of resort to litigation and valuation.

Adequate commission staffs necessary for effectiveness of regulation

Protection of the real public interest in the public utilities and their rates needs and requires, far more than anything else, the granting of adequate appropriations and sufficient staffs to the state commissions. Political agitation about theories of valuation does not give to the commission a sufficient number of public-minded and competent employees in their technical departments such as engineering, accounting, law and supervision of properties and practices.

"Failure of regulation," so called, is commonly *a failure of appropriations* instead. The "breakdown" is in the executive and legislative departments, which withhold from the commissions well-trained and well-paid staffs, men of courage and ability such as enable them to act fearlessly alike in reviewing the acts of company staffs and in resisting the importunities of eager candidates for office and worse demagogues who hope to be candidates.

No governor or legislative leader has a right or reason, in my judgment, to lament or denounce any insufficiencies of state regulation until he has brought it about that the commissions are equipped with competent and independent staffs, adequate in size and sufficiently well paid to attract and hold men and women of first-grade ability and to make every one therein feel that the public service offers a permanent career at compensation sufficiently attractive to exclude the idea that transfer to company payrolls must be an early objective. Engineers, lawyers and accountants, no less than commissioners, should not be expected to deal efficiently and courageously with vast corporate properties, if all the time these guardians of the public interest are left without the means of maintaining a comfortable standard of living and educating their children.

If the budget makers of a state choose to have the public interest as to utility rates or securities safeguarded only by a $2,000 a year lawyer and a $1,200 a year engineer fresh from college, the fault is hardly that of the regulatory law or system. The company side is naturally represented by a staff more experienced and better paid, but that again is not a ground for censuring the regulatory law and system.

I have never been, and am not now, pessimistic that the political advocacy of this or that program will destroy the vital and useful part of the utilities and utility investments in American life. Remedial measures and improved public control may always be expected, and should sincerely be welcomed; abuses will and should be exposed and corrected; but in the last analysis, the public wants the best possible service at the lowest possible rates and under the most favorable rate forms, and it values those things more than adherence to any theories or rules of thumb, and the public is not likely to let anything disastrous be inflicted upon these great instrumentalities of public service under public control.

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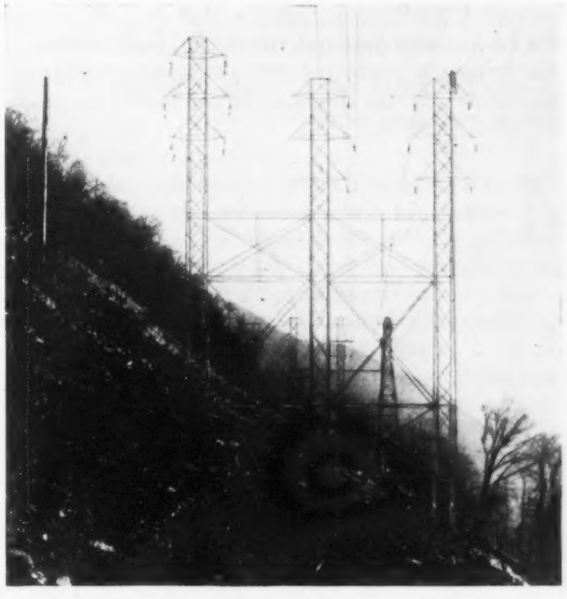
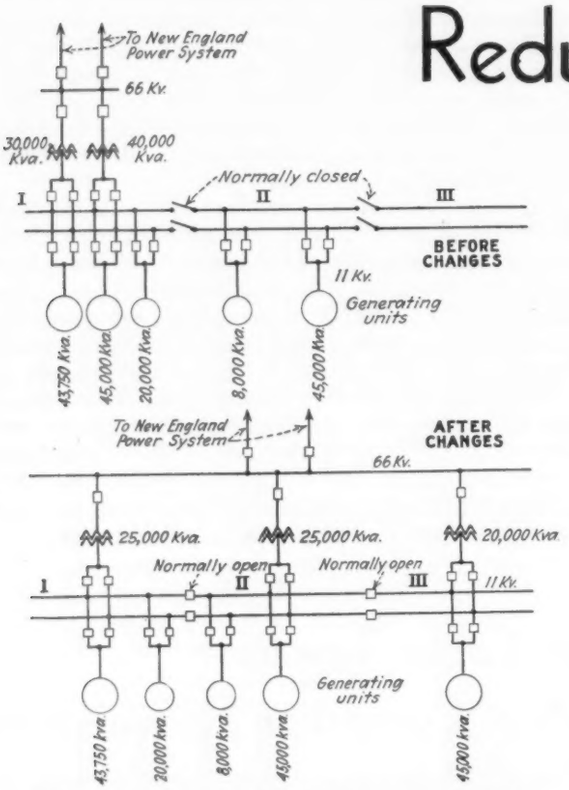
Six-Circuit Towers Meet Congestion Requirements



When the engineers of the American Gas & Electric Company reviewed the right-of-way conditions involved for the 44-kv. Cabin Creek-Belle-Lazote line of the Appalachian Electric Power Company it proved necessary to adopt a special six-circuit construction on a portion of the line which would require a minimum width of right-of-way and also be adapted to long-span, side-hill construction. Five circuits are at present installed with provisions for a future circuit.

Switch-House Changes Reduce Service Hazards

Reduction of short-circuit effects sought.
Sectionalized layout improved.
Bus and compartment reconstruction accomplished without impairing service.



Old and new bus and switching arrangements

Bus layout was rearranged with high-tension transformer capacity distributed among sections to provide more flexible service and take advantage of distributed bank reactance in minimizing short-circuit effects.

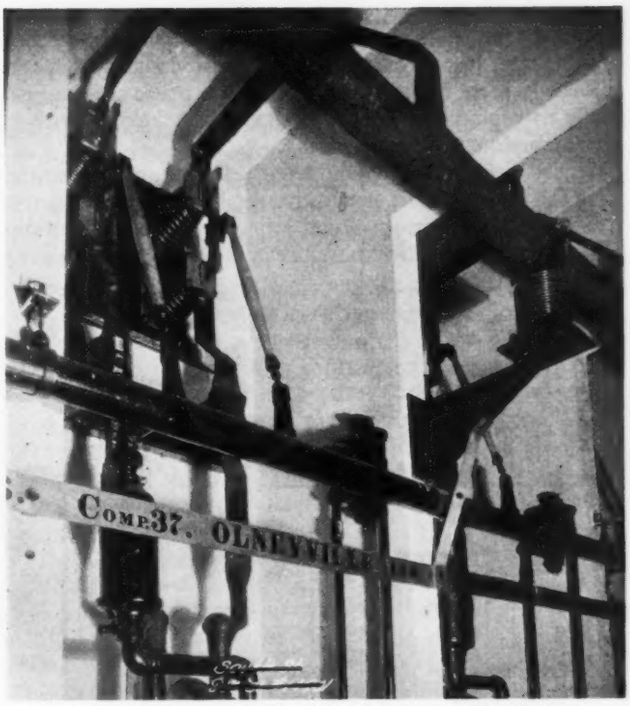
MAINTENANCE of continuous service at the South Street station of the Narragansett Electric Company in Providence, R. I., one of the largest steam auxiliaries of the New England Power Association, is of major importance to the system of interconnected properties operated by this organization. As a result of a heavy short circuit in the 11-kv. isolated-phase switch house of this plant in the summer of 1928 and consequent service interruption in the Rhode Island district, an extensive rehabilitation of the switching and bus layout was undertaken by the New England Power Construction Company with the objective of reducing the severity of bus shorts, reactor troubles and switch or breaker failures. The work included improved sectionalization of the bus layout, isolation of reactors, reconstruction of bus supports and connections and better emergency ventilation facilities.

Generation at South Street is at 11 kv. and distribution is at this voltage mainly, with some 22 kv. service through step-up transformers. The 11-kv. feeders are equipped with reactors of about 3 per cent on a 5,000-kva. basis. The 11-kv. switching consists of a double bus with selector oil circuit breakers contained in a vertical, isolated-phase switch house built in 1923. There are 45 circuit positions. The switch house was divided into three sections of fifteen circuits each, with the buses sectionalized by disconnecting switches.

The switch house buses run approximately east and west and are designated as the north and south buses, each bus consisting of sections called I, II and III from west to east respectively. In 1928 section I had connected to it four generating units totaling 109,000 kva.; all the step-up transformers connecting with the system, totaling 70,000 kva., and four or five distribution circuits. Section II had connected to it two generating units totaling 53,000 kw. and a number of distribution circuits. Section III had no generating capacity, no outside feed of any consequence, and was therefore dependent on section II. The bus short-circuit concentration was of the order of 1,670,000 kva. The circuit breakers installed had interrupting ratings of 500,000, 650,000, 900,000 and 1,400,000 kva.

The main buses were composed of $\frac{1}{4}$-in. x 4-in. bare copper bars carried by inverted bus supports attached to concrete cross-barriers between compartments. This had originally been a single line of bus supports with a maximum of four bars until the addition of a 43,750-kva. unit in section I in 1925 made necessary its reinforcement. At this time an identical second bus was installed, paralleling the original one and spaced 10 in. from it. Electrical ties were provided at intervals between the two buses, but no great attempt was made to provide mechanical bracing.

The failure which was the real beginning of all electrical rehabilitation work at South Street occurred at 5 o'clock in the afternoon. It developed into a double phase-to-ground bus short on section II, which spread to section III. It endured for a considerable time, because the generators were non-automatic except on differential, and was cleared only by opening all machine switches by hand and killing the station. When the smoke cleared away it was found that sections II and III were completely crippled, the north bus having dropped to the floor owing to excessive stresses and most of the circuit breakers in the north bus room having been badly damaged by the fire that ensued. The most serious aspect was that although the south bus and equipment was intact, it was absolutely useless because the south bus was dependent on cables crossing the north bus room



Typical feeder compartment in new layout
Note new bus, grounded supporting bracket and remote-operated "disconnects."

for connection to the feeders, and these cables, and the reactors as well, had been seriously damaged. At this time virtually all distribution substations were fed radially from South Street and service could not be restored until some feed was established from that point.

Many of the flashovers went to the steel reinforcing rods in the concrete cell work in an effort to reach ground. Heating in these rods caused considerable structural damage.

The generally accepted theory is that a heavy short circuit caused two bare wire reactors to flash over between turns and eventually to ground on two phases. Ionized gases from these arcs involved the bus, and from that point the spread was rapid and destructive.

After the failure numerous engineers were invited to look over the evidence and make recommendations for removing conditions which contributed to the origin and spread of the trouble. Briefly these recommendations were to:

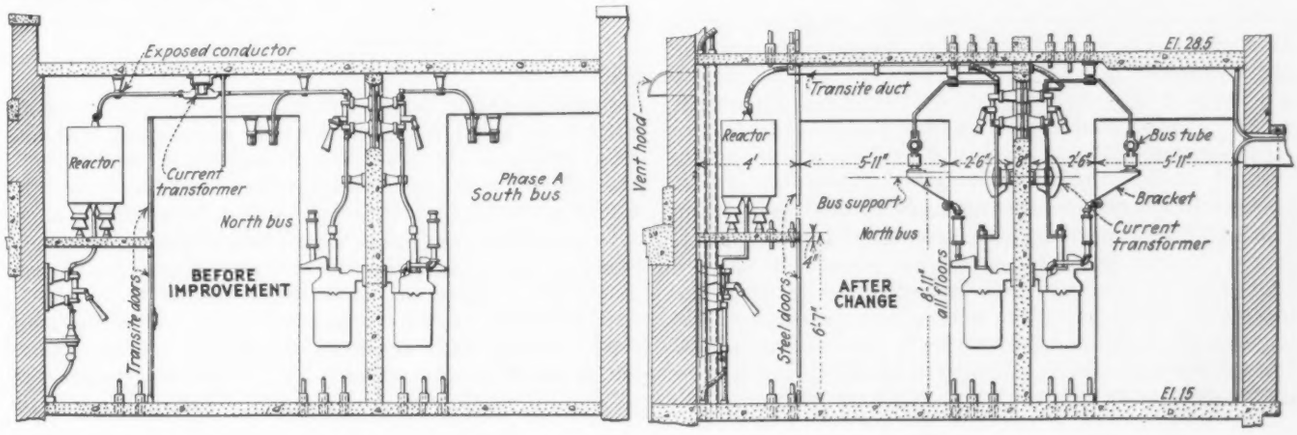
1. Replace bare wire reactors with insulated wire reactors.
2. Study methods of sectionalizing the bus, regrouping generator feeds and introducing reactance between sections.
3. Improve mechanical and electrical characteristics of main buses.
4. Reinforce ground bus system.
5. Provide further emergency ventilation.
6. Provide effective barriers at all possible points.
7. Study the relay situation with a view to clearing bus short circuits.

The first move was to replace the remaining bare-wire reactors with those of the insulated type. Next the large generators were equipped with overload relays having a relatively high current setting and considerable time.

One of the most important conclusions drawn from this failure was that steps should be taken to reduce the severity of the bus short circuit. The first solution considered was to divide the bus into three sections, with the generating capacity divided equally between the three sections, each section being tied to a synchronizing bus through reactors. While this scheme would have accomplished the desired result, it involved an expensive building addition which was an unproductive investment except in insuring service. In connection with other plans this synchronizing bus scheme was abandoned in favor of a broader future program calling for bringing the system connection into the Manchester Street station of the affiliated United Electric Railways Company 2,000 ft. distant at 110 kv. and using the 110-kv. bus at this point as a synchronizing bus for South Street. At this new 110-kv. substation would be installed three large banks of transformers stepping down to 11 kv. and each bank tying through cables to a separate 11-kv. section at South Street. At Manchester Street it was planned eventually to install a three-section 11-kv. bus duplicating the South Street bus and acting as a back-up for it. All important substations would be fed by duplicate feeders from corresponding bus sections at both South Street and Manchester Street.

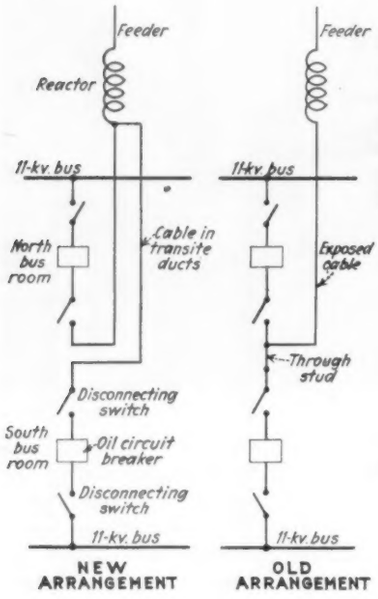
Fulfillment of this plan was naturally several years in

Isolated-phase bus rooms before and after improvement
Exposed conductors leading to bare reactors increased short-circuit hazard before improvement. Insulated reactor connections and relocated buses and current transformers removed weak spots.

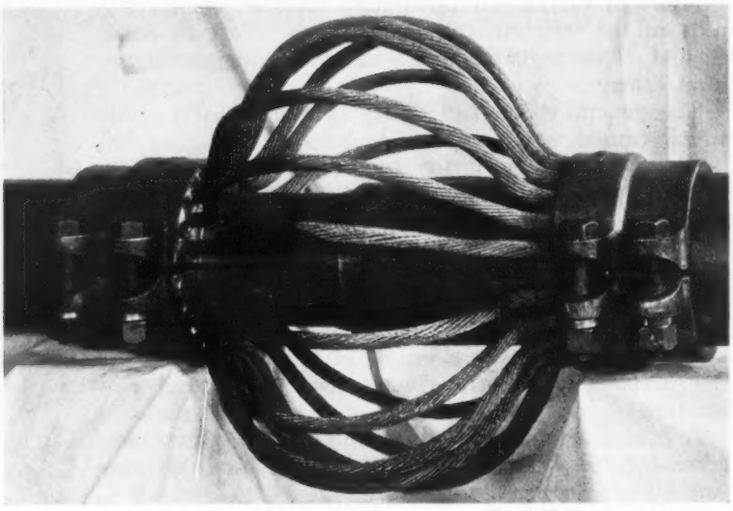


the future, but it was decided to start on the program at South Street to the extent of relocating the generator circuits to give proper distribution of capacity between the three sections. At the same time preparations were made to replace the sectionalizing "disconnects" with oil circuit breakers.

These changes were completed last year, and since that time the 66-kv. transformer circuits have been rearranged to give approximately equal capacity between sections. Sectionalized operation now prevails when the three large



Separate connections to reactor and pothead terminals provided in new layout



Bus expansion joint

Burndy Engineering Company, Inc.

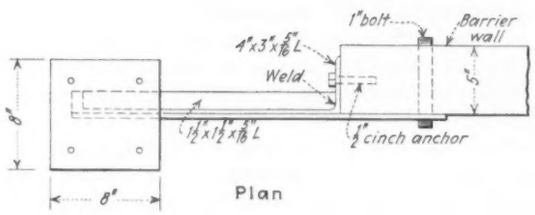
units are in use, with the 66-kv. bus acting as the synchronizing bus and the transformers providing useful reactance between sections. In the process of rehabilitation the feeder circuits have been rearranged to eliminate intersection ties. As the bus now stands the bus short-circuit values are: Section I, 690,000 kva.; section II, 780,000 kva.; section III, 560,000 kva.

This is still in excess of some breaker ratings, but these breakers are used on circuits equipped either with reactors, or with transformers stepping up to 22 kv. which bring the duty within the breaker rating for anything except a station short. It is nevertheless planned to replace these types of breakers in the near future with breakers of adequate capacity.

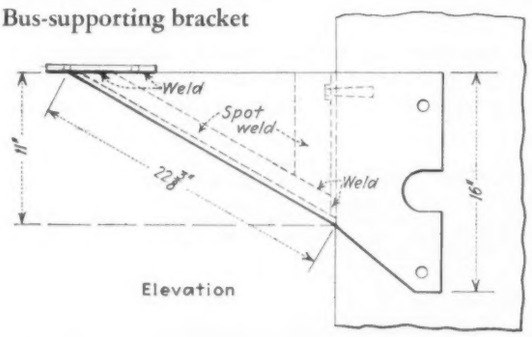
Improved compartment design

Extensive changes have been made in the compartment arrangement. Under the old arrangement the common connection between the two buses on all circuits was made at the jaw end of the breaker isolating "disconnects." These "disconnects" were mounted back to back on the center wall, and the tie was made by a stud passing through a porcelain bushing common to both sets of disconnects. Connection was made from this point to the reactor or cable pothead by an exposed cable passing across the ceiling of the north bus room. It was the failure of this cable in 1928 that rendered the spare bus useless. The first step was to eliminate the through stud between the two sets of disconnects. In connection with this change the ebony asbestos panel upon which these disconnects were mounted was replaced with a solidly grounded steel plate. Then separate cables were provided in transite ducts across the north bus room, each serving for one bus and the cables coming together at the reactor or pothead terminal.

This change involved the relocation of the current transformers which had previously been located in the cable run across the north bus ceiling. This relocation was accomplished by using two sets of current transformers for each circuit, one in the north and one in the south bus room on the feeder side of the circuit breakers



Bus-supporting bracket



and inside of the isolating disconnects. The secondaries of the two current transformers are in parallel and one is normally dead. The impedance is, however, so high that there is no appreciable error introduced by this shunt circuit. Two benefits resulted from this change. The current transformers were removed from close proximity to the bus, and they were placed in position to protect the disconnects and cable to the reactor.

The reactor cells were inclosed with tight-fitting steel doors having vent openings covered with fine bronze screening for fire protection. The frames and doors were all bonded together with a continuous ¼-in. x 3-in. copper

bus tied in with the station ground. Further than this the whole ground bus system throughout the switch house was reinforced, and ties were made to all metal at ground potential.

Reconstruction of buses

Perhaps the most difficult part of the work was the reconstruction of the bus itself. The objects were (1) to provide mechanical strength entirely adequate for all stresses; (2) to provide current capacity ample for present and future needs; (3) to insulate or isolate the bus so as to protect it from ionized gases.

Space was so limited that inclosing the bus in a continuous compartment was out of the question, so that the insulation contemplated had to be applied directly to the conductor. This had a large bearing on the form of conductor chosen. Many types of construction were considered, including ordinary bar, hollow, square and tubular of both copper and aluminum. The material finally chosen was 4-in. "EHIPS" copper tubing, the two main reasons being that it lent itself to insulation more readily than other types and that it could safely be supported at 8-ft. intervals instead of 4-ft. as would have been the case with other forms. Tap connections and splices were made by means of clamp fittings.

It was early decided that insulation of the order of 5,000 volts would be sufficient for all purposes. This corresponded to five half lap layers of varnished cambric. Tests were made on this insulation and also on micarta tubing $\frac{1}{8}$-in. thick. The micarta proved superior to the varnished cambric in dielectric strength, fire-resisting qualities and cost of application and was therefore the material chosen. In this installation there is a bus support every 8 ft. and a tap every 4 ft. The micarta was purchased with a 1/32-in. tolerance over the outside diameter of the copper tube and applied in one piece from tap to tap, extending through bus supports. After assembly the fittings were taped to the required thickness with varnished cambric, and then the whole assembly was covered with a single layer of asbestos tape. The surface was painted with two coats of black flameproof cable paint.

Tests made on the bus materials revealed an interesting fact in that for the same temperature rise the insulated bus had greater carrying capacity than the bare tubing. At 4,000 amp. the insulated bus had a rise of 32 deg. C. This same rise was produced in the bare bus with 3,200 amp. passing through it. Tests made on clamp-type couplings at currents up to 4,000 amp. showed conductivity equal to the bus itself and no apparent heating.

Bus stresses studied

In an isolated phase bus the mechanical forces between phases of the bus itself under short-circuit conditions are negligible. The largest forces are due to the reaction from the branch circuits. These stresses were investigated by Prof. H. B. Dwight of the Massachusetts Institute of Technology, and found to be of the order of 2,450 lb. downward and 1,300 lb. horizontally per bus support. These are the values which would exist under the very worst conditions of a single-phase short, totally offset wave, and at the instant of short circuit. The peak current used in these calculations was 223,000 amp. Even under these conditions the bus supports used have a considerable factor of safety.

Considerable difficulty was experienced in designing a suitable bracket for supporting the bus. Since the major short-circuit force was downward, it was desirable to have the bus supports upright, taking this reaction and the dead weight in compression. In addition, this type of mounting prevents the bus from dropping more than a few inches on the failure of a bus support. A fabricated bracket was finally worked out which had the necessary strength and was not too bulky or awkward. It was designed to utilize two 1-in. bolts which were already in place for attachment. Inasmuch as 120 of these brackets were used, considerable time and money was saved by this feature. Each bracket was tied to a continuous $\frac{1}{4}$-in. x 3-in. ground bus with a short $\frac{1}{4}$-in. x 2-in. strap.

Some heating was anticipated in these brackets, but from information available the exact rise could not be calculated. A test was made on one of these brackets in its proper position in relation to the bus carrying 4,000 amp. and a maximum rise of 13 deg. C. in temperature was recorded.

These brackets were designed for adequate strength and stiffness in a vertical direction, but some flexibility was allowed along the direction of the bus to take care of expansion. Each continuous section of bus—that is, between sectionalizing breakers—is 60 ft. in length, and this was divided into two 30-ft. sections by expansion joints. Each 30-ft. section is carried by four bus supports on 8-ft. centers, making 24 ft. between outside supports. The expansion in this length is 0.318 in. for a temperature range of 10 deg. to 75 deg. C.

Each bus passes through four 5-in. concrete partition walls. At these points 25-kv. porcelain wall bushings are used. These are provided with a bronze insert at the center, fitting the tubing closely, and the inside surface is sanded and copper-plated. The insert and plating are bonded to the conductor, eliminating entirely any corona breakdown, and in addition the close-fitting, insert forms a practically gas-tight seal.

Connector fittings used were of high-conductivity cast copper with non-ferrous bolts. Branch circuits are all of strap copper insulated with varnished cambric, asbestos tape and flameproof finish.

Ventilation system improved

The switch house as built was provided with normal ventilation in the north bus room only. From a single blower having a capacity of 11,000 cu.ft. per minute the air was led in ducts to one end of each section on each phase floor. From this point it traveled the length of the room and went out through exit ducts connected to roof ventilators at the opposite ends. The ventilating air was not filtered. The south bus room had neither normal nor emergency ventilation.

The original ventilating scheme in the north bus room gave a change of air every nine minutes. It was found practicable to increase the output of the existing blower to 15,000 cu.ft. per minute by changing the motor from 440 to 570 r.p.m., and increasing the horsepower. This gives a change of air every five and one-half minutes. The reactors having been inclosed in relatively tight cells, it was necessary to provide positive air circulation around them. This was accomplished by closing the old exhaust duct system and providing an air outlet in the outside wall of each reactor cell. The number of reactors in each section varied somewhat, and therefore the number of outlets, so that this feature regulates to some extent

the amount of air supplied to a section. The blower was in addition equipped with a filter of the oil type.

The old exhaust ducts and roof ventilators in the north bus room were converted into an emergency ventilating system. The roof ventilators were replaced with suction fans, and the ducts themselves were equipped with balanced dampers which remain closed normally and open when the fan starts. Each section of the south bus room was equipped with a vertical-exhaust duct system leading to a roof ventilator equipped with an exhaust fan. These ducts have no dampers, and the chimney effect without the fans running produces sufficient circulation for normal ventilation. The south bus room contains no reactors, and the ventilating requirements are therefore small. All six of the emergency fans are controlled from a panelboard in the switchboard room.

The north bus room emergency blowers have a capacity of 7,600 cu.ft. per minute, giving a change of air in three and one-half minutes. With the normal ventilating system also in operation this time is reduced. The south bus room blowers have a capacity of 4,500 cu.ft., which gives a change of air every four minutes.

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How Tennessee Copper Controls Demand Peaks

By L. W. HAYWARD
Power Superintendent
Tennessee Copper Company, Copperhill, Tenn.

If power is purchased on a demand-energy basis, the resulting power rate can be controlled to a large extent by exercising a close watch over demand peaks. The Tennessee Copper Company has worked out a system of watching its power peaks which has proved very satisfactory and has resulted in a decided improvement in its plant load factor and unit cost per kilowatt-hour.

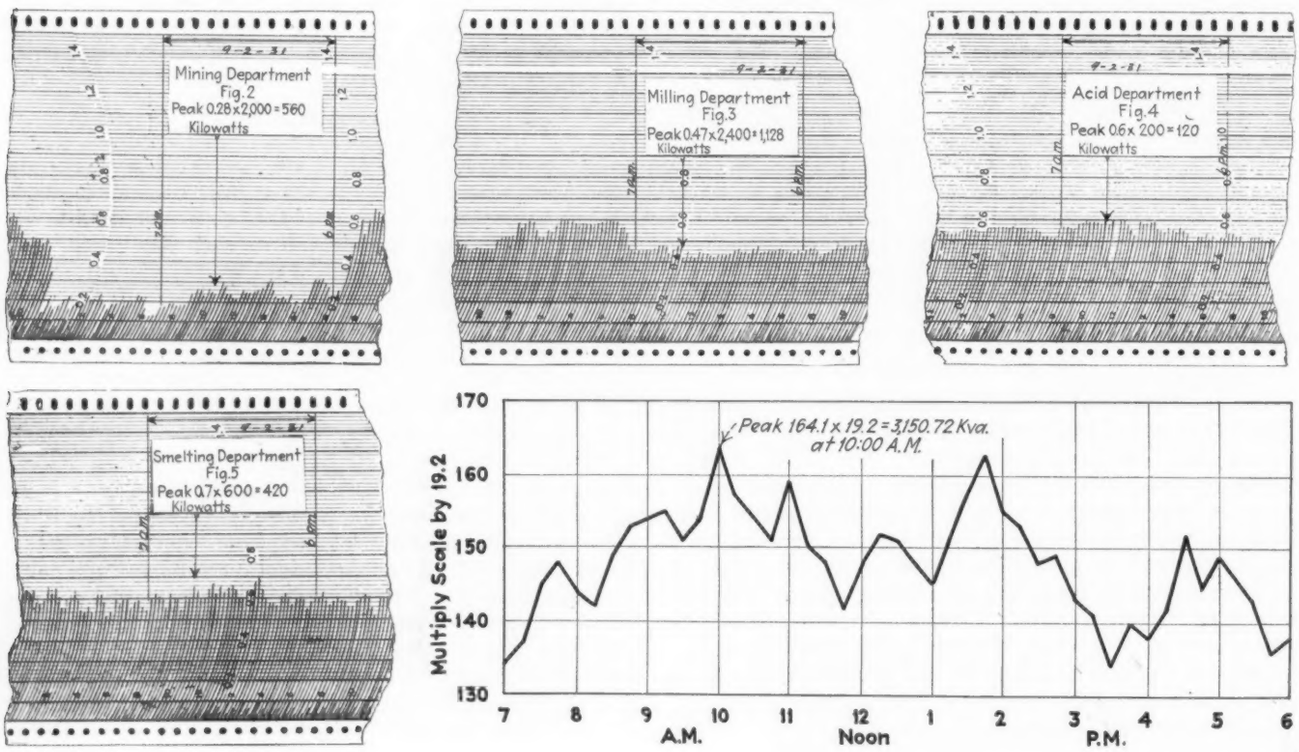
The company has four main departments, each of which are heavy users of power, also a few smaller departments which use only a small amount of energy and have little control of the power used. The four main departments are mining, milling, smelting and acid, each having from 60 to 200 motors. Each of these departments has a definite production schedule to meet each month with a fixed operating budget. As the cost of power is included in this budget, this item is very important to each departmental superintendent.

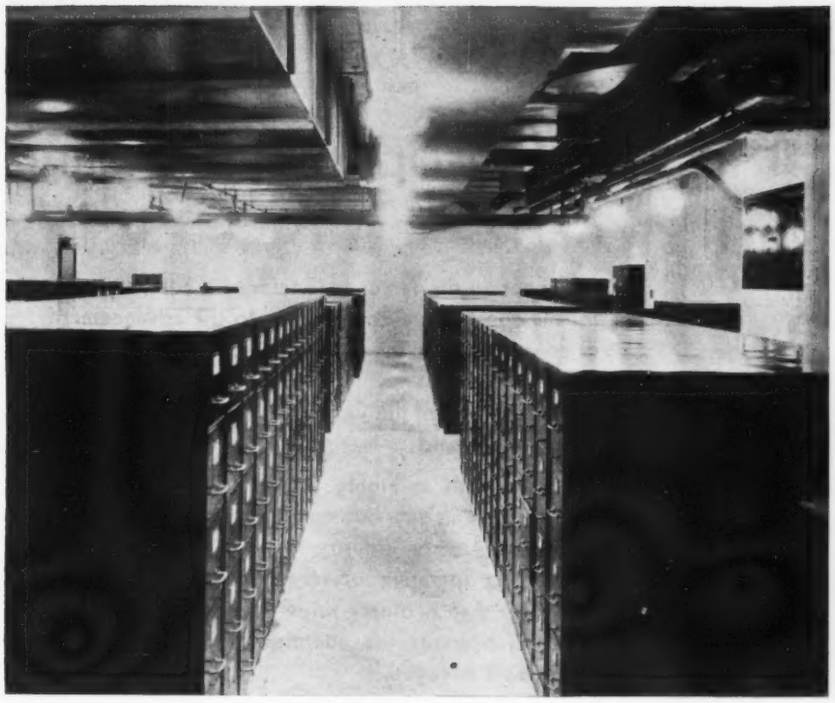
Power is purchased from the Tennessee Electric Power Company at a definite rate per kilowatt-hour plus a unit charge for each kva. of maximum demand. This demand is taken over fifteen-minute intervals. The incoming power is metered by General Electric Company PD strip chart meters at a central point and then distributed through overhead and underground cables to the departments. The energy used by the individual departments is metered by Westinghouse RA fifteen-minute roll chart, demand instruments. This makes it possible to determine the power demand of each individual department, as well as for the total power used.

It is only between the period from 7 a.m. to 6 p.m.

Department heads warned of contribution to plant peak

Each department superintendent is apprised daily of his department's contribution to the total demand by giving him copies of total and department demands with notations regarding time and magnitude of peaks so he can avoid coincidence.





Intensive File Lighting Speeds Clerical Work

The ability to find records quickly is a pressing necessity in a great insurance office. Lighting studies preceding equipment installation at the new building of the Aetna Life Insurance Company in Hartford, Conn., led to the adoption of 10 ft.-candles as an average intensity inside the filing department drawers. The ceiling height is 12 ft., the distance between files 4 ft. and the height of the five-drawer sections from the top of the case to the floor 60¼ in. Holophane No. 02176 units housing 100-watt lamps spaced 8 ft. apart and mounted 8 ft. above the floor provide the illumination.

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that the billing for maximum demand is figured, so it is over these eleven hours each day (Sundays and Saturday afternoons excepted) that the power peaks are watched. Each morning the total kva. load curve is plotted for the previous day, being taken from the PD strip chart meters. From this curve the time of the maximum demand is determined. The departmental RA demand meter charts are then torn off and the time of maximum demand, as determined from the total load curve, is marked on each department's chart. These charts are then sent to their respective departmental superintendents along with a copy of total demand curve so they can study the nature of their demand in respect to the total load.

Each department is billed for power on a kilowatt-hour and demand peak basis and this encourages them to keep their demand as low as possible so their power rate will be proportionally low. The time at which the maximum demand of the total power load occurs of course determines the time of billing demand for each department and it is at this time that each department tries to have its demand the lowest. Higher peaks often occur within departments at other times in the day, but as these peaks are not at the time of the billing peak they have no effect on the power rate. The time of maximum demand usually occurs between 9:30 a.m. and 11 a.m. or between 1 p.m. and 2 p.m. The mining department often comes on with very heavy peaks after 3:30 p.m., but as the other departments are usually lower at that time these peaks do not affect their rate.

The RA demand meters register kw. demand and not kva. demand. This works out very nicely as each department is billed on kw. demand basis. Departments have very little control over the power factor of their load, as the type of equipment installed determines this, and it is therefore felt they should not be penalized for poor power factor when it is not within their control. However, they are able to control to a large extent the time of their power peaks, and it is these peaks that are watched. It happened that the company owned a 1,200-hp. synchronous motor that was not in use and this is now floated on the line during demand periods as a synchronous condenser and keeps the total plant power factor very close to unity.

By giving each departmental superintendent an actual record each day of his demand in respect to time of total demand he is able to shift certain operations to off-peak periods. Also due to the 24-hour operation of the plant a good many loads which only occur at intervals each day can be shifted to afternoon and night shifts. This works out especially well in connection with pumping water from mines, crushing of ore and slag haulage. Also the operation of cranes and hoist motors is carefully watched. Each department knows what a horsepower of load costs it at time of maximum demand and can work out the economics of whether it pays to shift certain loads to times of off peaks or to absorb the additional demand charge.

Each day the power office plots the maximum demand peak on a yearly chart, also the time at which the peak occurs. At the end of each month the highest peak on the curve gives the billing demand for the month and shows the time of day it occurred. This is then referred to each department with a detail accounting of its power costs for the month.

To help each department improve its load factor and to co-ordinate the demand requirements of the different departments the power office is always at hand, but it is only through gaining the co-operation of departmental superintendents by giving them each day curves and figures on how their load affects their power costs and the total power bill that the desired results have been accomplished. The extent to which this is accomplished is told by our average monthly load factor of 85 to 90 per cent.

The Policy Back of Central Hudson Co-operative Selling

By T. R. BEAL
President Central Hudson Gas & Electric Corporation

In accepting the James H. McGraw medal, awarded for his constructive contribution to the advancement of co-operation in the electrical industry by developing a balanced system of market promotion, T. R. Beal, president of the Central Hudson Gas & Electric Corporation, said:

"This award is as highly prized as any honor that could come in my business career. It comes at a time when every industry is striving for efficiency through co-operative means and when any man may feel more than ordinary pride in making a contribution which merits the attention of the industry in which he is engaged."

But his acceptance address has more than the usual significance because he explained the factors that induced his company to embark on co-operative merchandising and the policies that guide its execution.

THE company I represent has been reported by many to have retired from the merchandising business. On the contrary, we are in it deeper than ever, viewed from our conception of the term merchandising, which in its broadest sense covers not merely the sale of the article, but the examination of the market, the choice of the product, the preparation of the customer's mind, training of sales personnel, the direct sale, the education of the customer in the use of the article and, finally, the provision for properly servicing the article. All of these factors enter into the merchandising of appliances and are assigned to the various members of the group, depending upon their ability to contribute to the operation as a whole.

With this conception of the word merchandising, involving the entire operation of supplying our customers with equipment to make the most convenient and economical use of electric service at the lowest prices commensurate with good service, the task is immense, for the reason that it comprises the carrying of information and knowledge of a new kind to every person within the confines of the territory we serve as to the benefits that electricity can render in every home, farm or business.

This job, we think, is too big for any one agency to carry out singly. It requires for its effective execution the full co-operation of all parties interested, the dealer, contractor, utility, jobber and manufacturer working together under a logical plan. Our company, with its recurring revenues and large potential future gains, is the one member of this group that can, without question, afford to take a long-range view in the development of the local electrical industry. Consequently, we feel that the promotional part of such a program should be carried out under its leadership.

Long-range forecasts made by the Central Hudson Gas & Electric Corporation several years ago have served as a guide to the management in visualizing the future of the entire electric business in the territory, with a better perspective than could be obtained through any other agency. These forecasts have been made the basis for the development of competitive rates and have indicated the necessity for new conceptions and new methods of merchandising. Based on these, we have developed our co-operative plan.* The plan itself seeks to provide wider and more efficient services to our customers and is based on the fundamental fact that every one who participates and follows the dictates of good business judgment must find it more profitable to co-operate than to continue old and wasteful methods.

Continuous analytical work has been undertaken by us for the reason that we alone are in a position to take the long-range view of the territory as a whole and to co-ordinate the information which we have with that obtained from independent sources. In addition, we provide leadership in the planning of sales programs with manufacturers, jobbers and dealers and provide educational facilities in connection with the training of salesmen. We finance installment sales, provide engineering and technical service on utilization problems, carry on continual educational work with the customer through home service workers and monthly publications. We have provided special plans covering the financing of complete electric homes and carry on continual promotional work in connection with the advantages of the use of electricity by our customers. Our advertising is coordinated with that of the dealers and we provide statistical information to the group, indicating periodically the results obtained. The direct sale of the appliances and a large part of the advertising and promotional work are handled by the dealers and contractors. The dealers and contractors are backed up by the jobbers and manufacturers and are able to plan their sales effort intelligently as a result of the analytical work which we carry on. The advantages of the plan are of peculiar value to the customer, since they are directed toward increased sales volume and consequent reduction of unit costs of distribution; of value to the dealer, manufacturer and jobber because of increased sales of equipment, and of value to the company in the development of increased revenue and diversified load.

Regarding the success of this co-operative movement to date, it is interesting to note that the participants

*See "Electrical World," March 7, 1931.

(including manufacturers, jobbers, dealers and contractors) sold from 10 to 15 per cent more appliances than they did in any of the three previous years during which co-operative practices have been under continuous development. In the light of these results we have a very fertile field for our imagination as to the future possibilities under full co-operative efforts.

It is our feeling that, great as have been the past gains, the principal benefits from our plan are to be obtained by putting it to work more intensively. We have, in fact, made only a fair start in the development of the electric industry in our territory. Our survey shows:

Ninety per cent of the present homes are inadequately wired.

Nearly all of the kitchens are old fashioned and require modernization to make possible the convenient use of electric service.

Practically all of the homes over five years old have inadequate and improper lighting.

With few exceptions, the houses are improperly ventilated and insulated.

Air conditioning is almost unknown in the home.

The sun lamp has only started on its career.

The electric clock will revolutionize timekeeping in the home.

New developments in the radio field make possible apparatus not even dreamed of a few years ago.

The application of electricity to the power requirements of the farm unfolds dozens of opportunities for the introduction of equipment which is not only useful but will result in definite savings to each farm properly utilizing it.

In changing from a plan under which the bulk of the business was carried on through the utility to one in which it is carried on through a large number of individual dealers it might appear to the manufacturer and jobber that the business is less profitable and less desirable, and if the representative of the manufacturer or jobber does not have the proper vision, the support given these dealers may be cut down to a point where their business actually suffers. On the other hand, we have found that if the manufacturer and jobber will select a proper group of dealer representatives and support them there will accrue many advantages which could not possibly be obtained by selling through the utility alone. If the dealers selected are properly trained and loyally supported they will become permanent agents and assure continuous representation. With proper encouragement the dealer will then assure the manufacturer of a growing business, whereas if the manufacturer were selling solely to the utility he would continuously face the possibility of having his product replaced by that of some other competing manufacturer.

Plans, however perfect, mean nothing unless properly carried out, but the fact should be constantly before us that the future of the electrical industry, of which we are all a part, depends entirely upon how well we serve our customers, the public.

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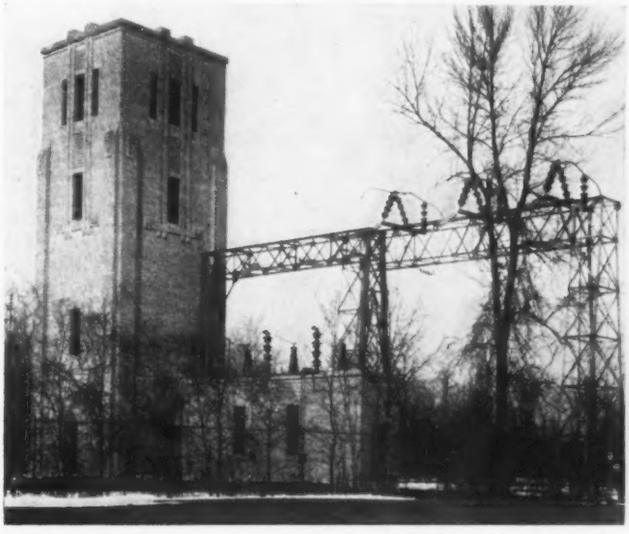
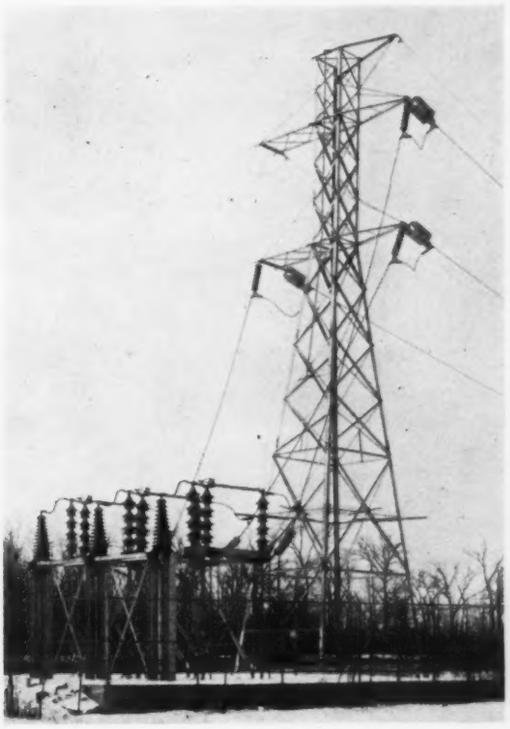
Spectacular Cost Reduction in 132-Kv. Cable Terminals

Economy of a major order is indicated by the contrast of these illustrations. One shows a 132-kv. cable terminal installed by the Commonwealth Edison Company in 1927 with a gravity pressure oil reservoir tower containing provision to keep the oil at above minimum temperature with electric heat. Rather an expensive terminal, but necessary in the early development of high-voltage cable art. The other shows the progress of three years. This terminal, adjacent to the first, was installed in 1930. It embodies simpler terminal construction and gas-pressure oil reservoirs installed underground. These improvements were made possible by the development and use of internal pressure reservoirs and of low viscosity oil that retains fluidity at low temperatures and thus does not require heating. The 132-kv. line built in 1930 showed a decrease in costs for special manholes and towers for stop joints and oil reservoirs of 81 per cent over the line installed in 1927.





Decorated pine trees fit well with ornamental street-lighting installations

Merry Christmas with Light

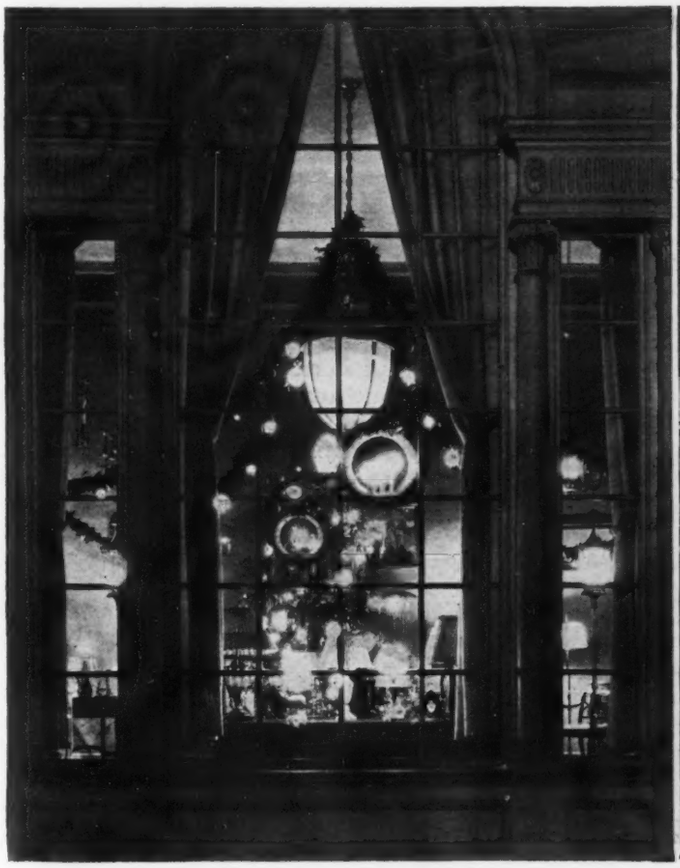
Home, highway, office, store, bank or community; it is all one when Christmas comes around. Decorative possibilities offer a twofold interest to the lighting engineer.

Floodlighting and window lights brighten this house in Poughkeepsie, N. Y.

35 kw. in decorative lighting for a Portland, Ore., home.

There is a contribution to the community celebration which light alone can add to the spirit of the occasion and the incremental use of electrical energy necessary to provide it. Light helps to make successful the all-electric Christmas.

An electric appliance display seen through a dealer's window in Cleveland



Christmas tree and illuminated wreath effects suitable for home or store

Use of Buried Cable for Underground Construction*

By W. R. BULLARD

Electric Bond & Share Company

The use of buried cable in underground construction, which is very largely practiced in European and other foreign countries, is not entirely new to this country, but has been confined to a few special types of installation.

This article by Mr. Bullard suggests the extension of the use of buried cable in order to effect construction economies and points out some of the savings which may be effected, as well as some of the operating advantages and disadvantages of buried cable. Since this is an important subject and one that has received comparatively little discussion, we hope that this article will form an incentive for a free discussion of the matter by our readers, including the submission of available operating and cost data, with a view toward bringing the subject out of opinionative standing in this country into the factual class.

FOR many years underground construction practice in European and certain other foreign countries has taken a different form than that considered characteristic of this country. I refer to the use of armored cable buried directly in the ground, such construction being practically standard for underground installations in general in many foreign countries.

It is commonly assumed that, except for special isolated cases, buried cable practice is not readily adaptable to governing conditions in the United States. The chief reasons for this assumption are that the growth of load in this country is considered to be more rapid than in other countries; that frequent changes in underground cable systems are necessary, and that facilities for such changes are not provided by buried cable construction. This viewpoint is undoubtedly sound to a certain extent, but contact with operating companies located in Latin American and other foreign countries has led the writer to question whether the economies incident to certain applications of buried cable construction have received sufficient consideration in this country. Certainly there are examples of complete success and satisfaction attending such applications in other countries, even in situations involving rapid load growth.

Some of the applications of buried cable construction worthy of consideration from the standpoint of economy and general suitability are:

1. Single tie lines between substations, and other transmission lines of a permanent type in situations where there is little likelihood of additional lines being required.
2. Series street-lighting circuits or control circuits for multiple street lighting.
3. Primary laterals of distribution systems.
4. Low-voltage secondary mains of distribution systems.

One or more of these applications may exist in the same location; that is, buried cable circuits of different types may be installed in the same trench. But it is, of course, understood that where conduit construction is used for any purpose there is no reason for the separate use of buried cable construction at the same location, except to satisfy special conditions, as, for instance, the use of single-conductor, non-metallic armored, buried cable in low-voltage distribution circuits to mitigate short-circuit troubles. Also, it should be noted that as the number of cables in a given location is increased many of the advantages of buried cable construction begin to disappear, and in situations involving a reasonably large number of circuits, say five or more, the advantages are usually in favor of conduit construction, except to satisfy special conditions such as the case mentioned above.

All of the above applications are concerned with installations which are of a comparatively permanent character and involve little change over long periods of time. At first glance it might not be considered that the last two items come under this classification, but a little consideration will show that, if the design of these parts of the distribution system is carried out on a reasonably liberal basis, the growth of load over long periods of time can be handled with practically no change in the secondary cables and with comparatively few extensions of primary cables, the chief increases in distribution system investment being due to additional transformer installations.

Advantages of buried cable

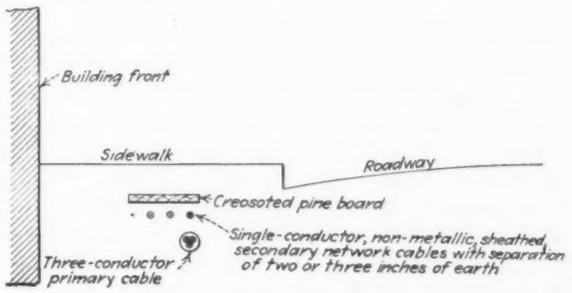
For the particular applications of buried cable outlined the following advantages are being obtained in many actual installations in foreign countries.

1. *Low Cost*—In situations involving a small number of cables appreciable savings are often made in investment cost by using buried cable in preference to conduit

**Presented before recent N.E.L.A. underground systems committee.*

construction. This is due to the absence of the conduit structure, including manholes; to the smaller amount of excavation required (particularly excavation for manholes, and deeper trenches at street intersections to avoid obstructions crossing the conduit line), and to the fact that in many situations the flexibility of and small space occupied by buried cable permits its installation in sidewalk areas, whereas conduit construction in many of these same situations would be forced into the street for lack of space. The use of the sidewalk areas usually involves considerable saving due to the lower cost of sidewalk paving as compared to heavy roadway paving. Also, excavation in the street area is frequently more expensive due to traffic conditions.

The savings mentioned here may be partially compensated by the additional cost of the cable due to the use of


Building front
Sidewalk
Roadway
Creosoted pine board
Single-conductor, non-metallic, sheathed secondary network cables with separation of two or three inches of earth
Three-conductor primary cable

Under-sidewalk space convenient for buried cables

Application shows buried cable used for primary and secondary circuits of low-voltage a.c. network. Use of single-conductor, non-metallic-sheathed, low-voltage cables gives protection against short circuits.

protective armor, but this difference in cable cost is usually small in comparison to the other savings. The overall saving in first cost of buried cable as compared to conduit construction is largely dependent upon the number of cables to be installed, both present and future. Thus in the case of main trunk lines of transmission or distribution feeders, involving a number of cables initially and/or frequent additional installation of cables to handle load growth, conduit construction is usually more economical.

2. *Flexibility of Installation*—Conduit construction involves careful grading of the trench and careful location to avoid subsurface structures. The conduit occupies an appreciable amount of space and is comparatively inflexible; that is, any bends must be quite gradual. Buried cable, on the other hand, permits a considerably greater choice of location due to the smaller space occupied and its physical flexibility, thereby avoiding or considerably reducing survey work in connection with detailed installation design, and frequently avoiding expensive relocation of other underground structures. It is frequently unnecessary in making buried cable installations to make any preliminary survey of subsurface conditions. In such cases the trench is opened where it is desired to locate the cable and any existing subsurface structures are avoided simply by bending the cable so as to accommodate any vacant space which is available.

3. *Protection from Mechanical Damage*—Operating experience in certain situations familiar to the writer has shown buried cable installations to be remarkably free from troubles due to mechanical damage. In conduit installations persons entering the manholes sometimes accidentally cause mechanical damage to cable sheath in carrying out work in other cables. Furthermore, normal movement of the cable caused by expansion and contraction due to load cycles may involve trouble by abrasion of cable sheaths at duct edges, or by crystallizing the lead sheath and distributing the homogeneity of the insulation, etc. Buried cables used for the applications here considered are subject to mechanical damage almost solely by disturbances due to excavations in the street made by contractors or other utilities.

Operating experience in certain foreign situations has shown such troubles to be quite infrequent (perhaps not considerably greater in number than similar disturbances to conduit systems by excavation work under American conditions), although in one situation known to the writer such troubles have been sufficiently frequent to cause considerable annoyance. Where trouble occurs from this source its location is immediately known, and since the cable is exposed, repairs can be rapidly and easily carried out.

Due to the better temperature conditions and the rigidity provided by earth pressure troubles from expansion and contraction are seldom encountered in the applications of buried cable here considered. However, in the case of large, heavily loaded main transmission cables (particularly high-voltage cables) some troubles have been experienced due to mechanical strains produced by temperature cycles.

4. *Current-Carrying Capacity*—Buried cable usually has an appreciably greater current-carrying capacity than cable in conduit due to the direct contact of the former with the soil.

5. *Space Occupied*—Buried cable is frequently less objectionable from the standpoint of other utilities occupying street space since it occupies less space than conduit systems. This statement applies to the particular applications of buried cable outlined above. Usually in these applications few cables are involved in a single location.

Disadvantages of buried cable

1. *System Changes*—The chief disadvantage of buried cable as noted previously is the lack of facilities for replacing cable in the case of necessity for system changes. This also includes the difficulty of salvaging cable which may be abandoned for any reason. However, for the applications here being considered these considerations are frequently of minor importance, since these applications constitute installations of a permanent nature where few changes are contemplated for long periods of time.

2. *Locating Trouble and Making Repairs*—A question which is frequently asked concerns the comparative facility with which trouble can be located and cleared in the two types of systems. Basically, it would appear that locating trouble would be more difficult in buried cable systems and that the cost of repairing the trouble would be greater. This is true to a certain extent, but operating experience in actual installations of buried cable have indicated that with proper equipment and organization trouble can usually be very rapidly located and that the cost of repairs need not ordinarily be excessive.

Trouble in low-voltage distribution circuits usually makes its location known by audible or visual dis-

turbance or by its effects upon service conditions. In the majority of cases trouble on high-voltage circuits can be located by means of bridge measurements and other methods within a few feet before any excavation is made. Where taps are made on high-voltage buried cable circuits it is usually desirable to resort to a moderate amount of sectionalization in order to facilitate trouble hunting. However, very simple sectionalizing devices usually suffice for this purpose. After the trouble is located the cost of repairing includes the expense of removing a section of paving and making a moderate excavation.

Excavation also is objectionable from the standpoint of the public. However, it is not necessary to draw out and replace a complete section of cable, as is frequently the case in conduit systems. Furthermore, as previously stated, in some situations known to the writer troubles with buried cables have been remarkably infrequent.

Types of buried cable construction

There are now in use two general types of buried cable construction—one employing cable with steel or other metallic armor and the other employing the so-called non-metallic-sheathed cable. In the case of the metallic-armored cable, which is usually of the lead-sheathed type, it is common practice to use overlapping steel tapes for the armor, with jute bedding between the lead sheath and the armor and one or more layers of jute over all. Of non-metallic-sheathed cables (a comparatively recent development) there are now a number of types on the market, each manufacturer using a construction somewhat different from the others. Curiously enough, this is almost exclusively an American development. In general, it can be said that such cable usually consists of rubber-insulated conductors with one or more layers of fibrous or other types of non-metallic coverings for mechanical protection. Some form of moisture seal is used in most cases. This often consists of successive dippings or coatings of a sealing compound such as asphalt.

One manufacturer uses an extruded sheath of sulphonated oils over the insulation for moisture proofing, and another manufacturer uses an especially tough rubber-insulating compound which serves as insulation, moisture proofing and mechanical protection, all combined in one material.

In some buried cable installations employing steel-armored cable the cable is surrounded with a few inches of fresh water sand in order to mitigate corrosion of the steel armor by chemicals in the soil. It is common practice in the case of either steel-armored or non-metallic-sheathed cables to use some inexpensive form of mechanical protection in addition to the normal cable armor. For instance, creosoted pine boards may be laid over the cable before the trench is back filled. A row of bricks may be used for this purpose in locations where bricks are inexpensive or sometimes concrete slabs are used. A reasonable depth for high-voltage cables is approximately 3 ft. below the surface. Low-voltage cables, such as network secondaries, are normally located somewhat shallower in the ground than the cables of higher voltage. Where both high- and low-voltage cables are installed in the same trench the high-voltage cables are usually placed below the others.

The use of non-metallic-sheathed cables in low-voltage network systems has received considerable attention within recent months, since such cables offer a possible means of mitigating or eliminating troubles from low-voltage short circuits which fail to clear themselves within a short tme. By the use of single-conductor cables spaced a few inches apart and buried directly in the earth it is believed that low-voltage network mains can be made practically short-circuit-proof—that is, any defect in the insulation will result merely in a leakage of current to ground, but will not result in the flow of current of short circuit magnitude. It has been demonstrated that such cables have better "burn-off" characteristics than lead-covered cables and this feature provides additional assurance of high-grade service reliability. Installations involving this principle have recently been placed in service and these installations will be carefully watched as to their performance, particularly the rate of deterioration of this type of cable in service, since the development is so recent that comparatively little is known concerning this feature.

Havana low-voltage network system

An example of low-voltage alternating-current networks of the automatic type employing steel-armored buried cable is the system which has been in operation for 2½ years in Havana, Cuba, a city of approximately 590,000 population. This system is of the usual radial primary type, the 13.2-kv. primary feeders being connected directly to the generating station bus through induction regulators and the three-phase, delta-wye-connected distribution transformers feeding the 120/208-volt network through standard automatic network switches.

The secondary cables of this system are four-conductor, paper insulated, lead covered and steel tape armored, buried directly in the ground with an envelope of sand and a covering of creosoted pine boards. For narrow streets, where the mains are located on one side of the street only, the conductor size is 500,000 circ.mil. For wide streets, where mains on both sides of the street are used, the conductor size is 250,000 circ.mil. The primary feeders from the generating station to the center of distribution are ordinary paper-insulated, lead-covered cables in conduit, but the primary laterals are three-conductor, paper-insulated, lead-covered and steel-tape-armored cables.

Primary laterals are installed in the same trench with secondary mains and are located below the latter. If the Havana system had been of the usual type, employing conduit construction, probably no junction boxes or sectionalizing devices of any kind would have been used either in the primary or secondary circuits. However, since in a buried cable installation there is no access to the cable whatever except at sectionalizing points such as junction boxes, the secondary mains are sectionalized at street corners by the use of buried cast-iron junction boxes of the "flush" type, having a removable cover flush with the sidewalk and a sealed bolted inner cover. In these boxes the mains are connected directly to buses by means of ordinary lugs terminating the cable conductors; no fuses or disconnecting links are used. The primary laterals are sectionalized by being looped through junction boxes mounted on the three-phase distribution transformers. This system has been in operation approximately 2½ years and as far as the writer is aware no service outages have occurred attributable to the opera-

tion of the network system itself. One secondary short circuit has been experienced which destroyed a junction box, but service was maintained on the network during this trouble.

Santiago low-voltage network system

In Santiago, Chile, a city of 540,000 population, there is now in operation a network system similar in many respects to the Havana network, but in this case the network voltage is 220/380. Due to the higher network voltage and the consequent greater difficulty of burning off short circuits, it was thought best in this system to employ secondary cables of the single-conductor, non-metallic-sheathed type buried directly in the ground with 2 or 3-in. separation. The old distribution system in this city employed four-conductor, steel-armored cables, and where these can be reused on the new system they are being connected to the network, but provision is made for inserting fuses between these cables and the non-metallic-sheathed cables if it should ever be found desirable to do so. In this city a greater proportional amount of conduit has been installed than in most other Latin-American countries. This is due to the development by the operating company of a very inexpensive form of precast concrete ducts. Due to the availability of this existing conduit system practically all of the primary circuits of the initial installation consist of ordinary lead-covered cables in conduit.

This system has been in operation several months and so far has given entire satisfaction from the service standpoint. It will, of course, be watched with much interest due to its novel features.

Other installations of non-metallic-sheathed cables

The writer is aware of two other distribution systems employing low-voltage, single-conductor, non-metallic-sheathed cables buried directly in the ground. Both of these are in Mexico, one in the city of Vera Cruz and the other in Merida, Yucatan. These installations as regards the low-voltage cables are very similar to the Santiago system and will not be further described.

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490-Ft. Towers for 132-Kv. River Crossing

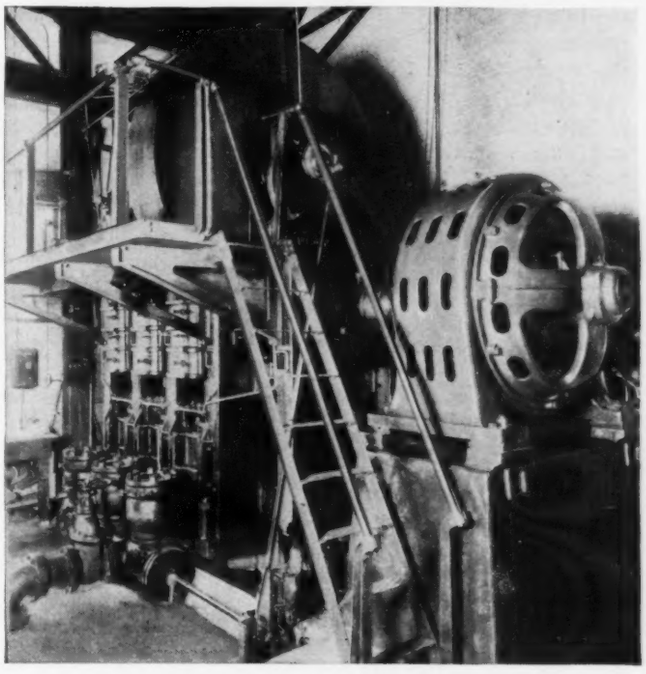
Towers 490 ft. high, with a 120-ft. base, will support the double-circuit 132-kv. lines which will be erected across the Thames River, England, from Barking station to Swanscombe switching station, according to the *London Electrician*.

The span of 3,060 ft. will be suspended 250 ft. above mean high water level, each conductor to consist of a nineteen-strand cadmium-copper core and a 42-strand aluminum-bronze exterior measuring 0.918 in. over-all diameter. Up to 20 ft. below the bottom crossarm the steel structure will be riveted and painted. Above this elevation galvanized bolted construction will be used. Each crossarm will have a rail from end to end from which a traveling chair may be suspended for maintenance work. Access to the tower will initially be provided by railed ladders with resting platforms at 50-ft. intervals, but space has been provided for installing an elevator.

Automatic Pump Unloader Aids Synchronous Motor Drive

By equipping a triplex reciprocating pump with an automatic unloader which works in conjunction with the motor control to unload the pump automatically, it was recently made possible to drive the pump with a synchronous motor. The unloader is of the Holveck type. Without the unloader the pump would have had to be unloaded manually by an operator, and manually loaded when the motor is up to speed and synchronized because it was not feasible to provide the motor with full-load starting torque. With the automatic unloader, working in conjunction with the frequency responsive control, the entire starting operation is made automatic, it being necessary only to push the start button.

A magnetic solenoid operating a pawl controls the rotation of a camshaft for holding open the suction valves. The lifting cams are operated by a rod connected eccentrically to the pump crankshaft. When the solenoid is de-energized the cams are so rotated that the suction valves are held open during the normal pumping stroke. When the solenoid is energized the cams are rotated away from the suction valve lifts and stopped to permit regular pump operation.



Pump unloader in lower foreground

By use of this unloader for a synchronous motor-driven reciprocating pump the following advantages are gained: (1) Permits continuous operation without attention, regardless of momentary power dips which would otherwise shut down the pump; (2) simplifies starting; (3) makes possible automatic start and stop operation to maintain the desired liquid level or pressure in the tank.

The application was made by the Electric Machinery Manufacturing Company.

READERS' FORUM

Wanted: Exhibit-Minded Men at Next N.E.L.A. Convention

To the Editor of the ELECTRICAL WORLD:

Preston S. Arkwright's interesting communication in your November 14 number, "A Point of View on the N.E.L.A. Convention," and your heading, "Don't Give Up the Exhibit," page 849, give two points of view, one of an outstanding public utility executive, the other of a publication internationally recognized as a real force in our industry.

But there is still another viewpoint, that of the manufacturers, who at the last convention played to an empty house, empty because many executives saw fit to withhold tickets of admission to men who should have been there.

Mr. Arkwright is undoubtedly sold on the importance of the exhibit, for he says it is educational, is a necessity and should be studied. His closing paragraph reads: "A man who goes to the convention with this purpose uppermost in his mind will save many times the cost of his trip in the earnings that will result." He also says: "The comparatively small expense is not the controlling factor—and the volume of our business justifies it."

But on page 875 he admits that operating companies were not very liberal in sending representatives to the last convention, the number of men authorized to attend was held down, and he then says: "I don't know how we are going to help this, because if business doesn't pick up very considerably, we will still be economizing next year on convention expense as well as everything else."

As compared to decreased business and income of manufacturers, public utilities have suffered little, so if next year's convention attendance is to be a carbon copy of last year's, why any exhibit, why not wait until business picks up?

Would it not be possible for the N.E.L.A. to make a survey as to next year's attendance of men to whom the exhibit would be of value? Quoting Mr. Arkwright again: "Every power company should be urged to send to the convention those engineers and commercial men who are best fitted to study the exhibit from both the operating and load-building angles."

This is the day of "pledges." Could not the power companies be induced to pledge a certain number of the type suggested by Mr. Arkwright? You won't have to pledge the manufacturers; they have always been sold on the convention exhibit.

Should a survey forecast another small attendance of engineers, construction, purchasing and other men naturally interested in the exhibit, then how would it be for some of us to stay home and give the other fellows a chance to go?

I don't know how many privates could go for the upkeep of one officer, but your statistical department may be able to riddle that out. Mr. Arkwright wants exhibit reports by men who attend, and in my humble opinion the executive officers are not apt to make them, so let's have in 1932 the men who really will; men from the engineering, construction, purchasing, maintenance and new-business departments.

H. W. YOUNG,
President.

Delta-Star Electric Company,
Chicago.

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BOOK REVIEWS

Die Industrie des Kalziumkarbides

By Dr. Rudolf Taussig. Wilhelm Knapp, Halle (Saale). 518 pages, 194 illustrations, 22 supplementary plates. Price, paper, 60 reichsmarks; bound, 64 reichsmarks.

From the same publisher there has come a long series of monographs on applied electrochemistry, of which the present is the 51st volume. In a necessarily brief note it can only be said that the author has brought together and carefully co-ordinated a remarkable amount of information—descriptive, technical, economic and statistical, with an interesting historical introduction. It would seem that he has not only covered the various aspects of the calcium carbide industry including discussion of the sources and properties of raw materials, but has followed through into the applications. The latter are of considerable diversity, with possibilities of important future expansion in certain directions, as in the making of synthetic products.

The economic section of the book includes discussions, with data, of the status of the carbide industry in individual countries, not overlooking those at present unimportant in this respect. The world's total installation is estimated at 600,000 kw., which is capable of producing 1,100,000 tons yearly, and consuming 3,200 to 4,000 kw.-hr. per ton.

The preface states that the book has been planned for chemists, electrical engineers and machinery builders connected with the carbide industry, also for prospective electrothermic specialists seeking theoretical material and working examples.

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Recent N.E.L.A. Committee Reports

Health Training: Building and Conducting the Training Program (Public Relations National Section, No. 146, September, 1931. Four pages. Price, 25 cents to non-members.)

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Cable Research. Summarizes results of research into deterioration, ionization and residuals. (Underground Systems, No. 160. October, 1931. Six pages, illustrated. Price, 25 cents to non-members.)

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Cable Operations. Exhaustive statistical analysis of operating experience of 13,784 miles of cable of more than 7.5 kv. along with joints, overheats, etc. (Underground Systems, No. 161. October, 1931. Twelve tables, fifteen graphs. Price, 40 cents to non-members.)

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Acceptance Inspection and Testing Cable (Underground Systems, No. 162. October, 1931. Sixteen tables, six charts. Price, 30 cents to non-members.)

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Electric Service Salesmanship—Appliance Course (Educational Committee, No. 171. November, 1931. Price, 15 cents to non-members.)

Men of the Industry

P. S. Clapp New Vice-President of Columbia Gas & Electric

PAUL S. CLAPP, whose resignation as managing director of the National Electric Light Association was announced in the December 5 issue of the ELECTRICAL WORLD, brings to the vice-presidency of the Columbia Gas & Electric Corporation a broad background of business experience obtained both in this country and abroad.

Mr. Clapp had been managing director

of the National Electric Light Association since the fall of 1926 and during this five-year period he promoted the program for the commercial development of the companies comprising the association, particularly in the fields of electric refrigeration and rural electrification. Prior to his connection with the National Electric Light Association Mr. Clapp was special assistant to the Secretary of Commerce. He was born in Iowa and was graduated from Iowa State College at Ames as an electrical engineer. He served as captain in the United States Army Signal Corps. From December, 1918, to February, 1919, he was associated with the Peace Commission in Paris as a member of the committee for the determination of damage in allied countries. Subsequently he established and supervised the telephone and telegraph service between the various capitals of Europe, by which the relief work was administered.

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L. C. PAUL has been appointed manager of the publicity bureau of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., to succeed T. H. Miller, who is now engaged in advertising work for the company. Some few years ago Mr. Paul was an associate editor of the *Electric Railway Journal*, a McGraw-Hill publication.

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WINTHROP ALLEN, who has been connected with E. I. du Pont de Nemours Company, Wilmington, Del., as assistant electrical engineer, now has associated himself with the Prudential Insurance Company, Newark, N. J., as electrical engineer of home office buildings.

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J. F. DAVENPORT, has been appointed superintendent of hydro generation of the Southern California Edison Company, Ltd., to succeed J. M. Gaylord, resigned. Mr. Gaylord has been appointed chief electrical engineer of the Metropolitan Water District of Southern California, with headquarters at Los Angeles. Mr. Davenport has been a member of the Edison organization 5½ years. Prior to that he held a position in the motive power department of the Boston & Albany Railroad. He is a graduate of the engineering school of Harvard University.

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WALTER A. SUTPHEN has been appointed power sales engineer of the central district of the New England Power Engineering & Service Corporation, a subsidiary of the New England Power Association, with headquarters in Worcester, Mass. To facilitate territorial coverage on a more decentralized basis the corporation has established a district power sales organization comparable in responsibility and headquarters contact arrangements with the steps taken some months ago to establish assistant treasuryships at various important centers on the system. All the appointees will report to Hugo Rocktaschel, sales manager of the parent company at Boston. Mr. Sutphen is a native of Plainfield, N. J., and was educated at Rensselaer Polytechnic Institute, receiving the M.E. degree in 1923. For three years he was in the engineering department of the Central Hudson Gas & Electric Company, Poughkeepsie, N. Y., then becoming assistant power engineer for the Kingston (N. Y.) Gas & Electric Company. Returning to the Central Hudson, he was appointed sub-district representative for the Catskill area, later returning to Poughkeepsie as general power engineer. He joined New England Power in 1929.

Dr. J. B. Whitehead Awarded Medal

DR. JOHN B. WHITEHEAD, professor of electrical engineering and dean of the faculty of engineering of Johns Hopkins University, Baltimore, has been made the recipient of the Elliott Cresson gold medal to be awarded by the Franklin Institute on May 18, 1932. This medal is to be conferred "in consideration of his many original investigations of dielectric behavior and allied sub-

jects." During the past ten years Dr. Whitehead has engaged in research work which has been of inestimable value to the electrical industry, receiving recognition for his efforts in this country as well as abroad.

Representative technical associations, in which he has been active for many years, have received the benefits of his studies. He was the founder of the Baltimore section of the American Institute of Electrical Engineers and for nineteen years served as its chairman. From 1924 to 1928 he was a member of the board of directors of the Institute and he has served as chairman or member of various committees. He was selected by the Institute as its representative on the division of engineering and industrial research of the National Research Council and as its delegate to the Conference Internationale des Grand Reseaux Electriques, Paris, in 1927.

Dr. Whitehead is a fellow of the American Physical Society and a member of the Society for the Promotion of Engineering Education, the National Institute of Social Sciences, the Société Française des Electriciens and the National Research Council. He was ex-

change professor to France 1926-1927. Honors awarded to him include the Edward Longstreth medal of the Franklin Institute, the triennial prize of the Institute Elektrotechnique Montefiore Liége, Belgium, 1922 and 1925, and the medal of honor of the University of Nancy, France, 1927.

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D. B. TAYLOR, formerly resident engineer, Albany district, New York Power & Light Corporation, Albany, N. Y., has taken over the superintendency of the Schenectady, N. Y., district of that company.

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W. W. ELMER of Portland has been appointed a member of the State Board of Enginering Examiners of Oregon.

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WALTER R. MUELLER has been elected treasurer of the Engineers' Society of Milwaukee.

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P. R. FARROW, formerly resident engineer for the Kaministiquia Power Company, Ltd., Kakabeka Falls, Ont., is now manager of operations for the Ontario Power Service Corporation, Fraserdale, Ont.

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RALPH R. CLARK has resigned from his position as power engineer of the Jackson district of the Consumers Power Company to join the Armstrong Cork Company of Lancaster, Pa., where he will be mechanical engineer in development work. Mr. Clark has been employed by the Consumers Power Company for nine years.

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FRED M. KIRBY of Wilkes-Barre, Pa., has been elected a member of the board of directors of the United Gas Improvement Company to fill the vacancy caused by the death of Charles Day. Mr. Kirby is vice-president and a director of T. W. Woolworth Company, New York; chairman of the board of the Miners Bank of Wilkes-Barre, a member of the executive committee and a director of the Lehigh Valley Railroad and a trustee of the Metropolitan Life Insurance Company and the American Surety Company. In addition he is president and a director of the Wilkes-Barre Railway Company and a director of the International Equity Corporation, the United States Lumber Company and numerous other corporations.

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W. R. PHIBBS, general manager of the Utah branch of the Columbia Steel Company, was elected a director of the Utah Power & Light Company at the annual stockholders' meeting held recently in Augusta, Me. Mr. Phibbs, in addition to his executive position with the Columbia Steel Company, a subsidiary of the United States Steel Corporation, is associated with other financial and industrial enterprises, among which are the Provo Commercial & Savings Bank of Provo, Utah, and the First Securities Corporation of Salt Lake City. He is a director of both of these institutions. He has resided in Utah during the last eight years, during which time he has become closely identified with the industrial development of the state.

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O. R. ETHERIDGE has been transferred to the power sales division of the Georgia Power Company after spending three years in the operating and engineering departments of the company. Mr. Etheridge joined the company in the summer of 1928 and was assigned to the Atlanta division operating department. Nine months later he was transferred to the engineering department as a member of the system planning and development section.

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OBITUARY

THOMAS A. COLLINS, director of public relations for the Lawrence (Mass.) Gas & Electric Company, lost his life by drowning November 29 in Havana harbor, Cuba. Mr. Collins was also manager of the Lawrence Automobile Club, Inc., and associate editor of *Contact*, the company paper of the New England Power Association. He was a native of Lawrence and unusually prominent in civic enterprises.

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JOHN H. HUNT, purchasing agent of the Pacific Gas & Electric Company, died recently, of a heart attack. Mr. Hunt was born in Massachusetts, but at an early age removed to the Pacific Coast and entered the employ of the Sutter Street Railway Company, where he remained for twenty years, advancing gradually to the position of assistant secretary. In 1903 he became assistant purchasing agent of the United Railways and two years later joined the San Francisco Gas & Electric Company in a similar capacity. In 1906, when the San Francisco utility merged in the Pacific Gas & Electric Company, he became purchasing agent of the new organization, retaining the position until his death.

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HOWARD R. SARGENT, engineer of the commercial engineering division of the merchandise department of the General Electric Company, Bridgeport, Conn., died December 8, following an attack of appendicitis. Born at Newton, Mass., he was graduated from Massachusetts Institute of Technology in 1893. He then entered the service of the old Thomson-Houston Company at Lynn, Mass., where he remained, except for an interval when he was working at Marlboro, Mass., until the transfer of many Lynn engineers to Schenectady in 1894, when Schenectady was made the home office of the General Electric Company. When the merchandise department of the company was organized in 1922 Mr. Sargent was transferred to Bridgeport as manager of the wiring supplies engineering division. He was made engineer of the merchandise department in 1926.

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E. S. ROWELL, construction engineer of the North Carolina Public Service Company, died recently at the age of 52. Mr. Rowell was born in New York City, was graduated from Columbia University and later became professor of mathematics at his alma mater. It was in 1919 that he joined the North Carolina company at Greensboro as construction engineer.

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JAN D. OTTEN, electrical engineer, Amsterdam, Holland, died in that city, September 29. Dr. Otten had retired from active professional practice in 1926. His early engineering work was in connection with the general European office of the Thomson-Houston International Company at Hamburg. Dr. Otten was a member for life of the American Institute of Electrical Engineers.

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CHARLES E. LONG, general electrician and hydro-electric power plant operator for the Puget Sound Power & Light Company's eastern district, Wenatchee, Wash., died recently in a mine accident. Mr. Long was born in Manitoba, Canada, and served an apprenticeship with the Toronto General Light & Power Company before starting an electrical contracting business of his own under the name of the Davidson Electric Company. After engaging in electrical construction work for the Canadian National Railways he removed to the United States in 1925.

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CEDRIC S. ANDERSON, electrical engineer of the Anaconda Wire & Cable Company, Hastings-on-Hudson, N. Y., died suddenly, November 13, while attending class at Columbia University. A graduate of the Massachusetts Institute of Technology, Mr. Anderson joined the Telluride Power Company at Telluride, Colo., in 1911. Upon the consolidation of several companies to form the Western Colorado Power Company he was appointed assistant to the general manager, and three years later he was made superintendent of the Clark Electric Power Company at Tooele, Utah. In 1919 he joined the West Penn Power Company at Pittsburgh as sales engineer. Subsequently he served as district superintendent and later power engineer. For the past three or four years he had been in Hastings.

Financial and Statistical News

MOVING with the market in general rather than independently, as formerly, utility stocks reached new lows this week in the face of satisfactory earnings and prospects, and without dividend reductions prevalent in other groups. A list of leading stocks now stands at less than one-sixth of 1929 top quotations. The market has ceased to reflect any relation to values, merely indicating complete paralysis of public participation.

——BOND PRICES REMAINED RELATIVELY FIRM DURING NOVEMBER, averages showing only a fractional drop. The decline was much less marked than during October and support came in to check each selling movement. Utility bond averages were higher at the end of November than at the end of October.

——UTILITY FINANCING SEEMS TO HAVE REACHED A STANDSTILL again after the offering of a few issues last week. Many branches of business and finance are apparently awaiting Congressional action.

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Utility Values Dropped 5 per Cent in November

PUBLIC UTILITY STOCK ISSUES listed on the New York Stock Exchange declined but 5 per cent during November, while the total value of all issues listed fell almost 10 per cent. The value on December 1 of all listed shares was $31,105,267,133, against $34,246,649,051 a month earlier. The December figure is the lowest in more than five years. The average price per share of all listed shares as of September 1 was $23.59, against $25.97 a month earlier.

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Bond & Share Gets Control of Affiliate

UPON THE EXPIRATION December 4 of the time within which holders of common stock and option warrants of the Electric Power & Light Corporation had the right to subscribe for additional common stock at $15 a share it was announced that Electric Bond & Share Company had acquired sufficient of the new stock to give it a majority of all of the common stock now to be outstanding.

The privilege of subscribing for the new common stock was offered October 31, 1931, ratably to holders of record of common stock and option warrants at the close of business on November 10 at the rate of 13/23ds of one new share of common stock for each one share or for each option warrant then outstanding.

Electric Bond & Share Company, as the owner of approximately 33 per cent of the common stock and of approximately 58 per cent of the option warrants, subscribed to its pro rata part (approximately 567,800 shares) of the offering. In accordance with an underwriting agreement entered into between Electric Bond & Share Company and Electric Power & Light Corporation at the time the offering was made the former company is taking up such of the remaining shares as were not taken by others entitled to subscribe. Electric Bond & Share Company underwrote this stock at the offering price of $15 per share for a fee of 50 cents per share on all shares offered to holders other than itself.

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Forms New Canadian Subsidiary

THERE HAS BEEN LAUNCHED by Utilities Power & Light Corporation, under Canadian laws, the Utilities Power & Light Corporation, Ltd., with a capital of 100,000 shares to own the stocks of Canadian and British companies now directly owned by the parent company. The chief British company concerned is the Greater London & Counties Trust, Ltd., which has wide holdings of utility properties in Great Britain. There are also several Canadian companies concerned scattered throughout various sections of the dominion.

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Budgeting New Construction

THE procedure followed in budgeting new construction is thus summarized by R. H. Ballard, president Southern California Edison Company, Ltd., in the *Executives' Service Bulletin:*

The program of new construction is planned by the engineering committee with the assistance of the districts and covers in complete detail all knowable items for both districts and general system. A provision is included for contingencies.

After estimates are approved, they constitute the working program for the year and set standards of performance for various departments. Several years' experience has made these estimates very accurate. Monthly comparisons with actual results provide a valuable check on operations.

The desire of district managers and department heads to "beat the budget" is not wholly approved by the management, as property must be maintained at a high standard and courteous, efficient service must be rendered. During the year 1930 the budget for new horsepower connected to the system was set at 365,000 hp., the same as the 1929 budget. This meant strenuous effort and several additional power and appliance salesmen were employed, with the result that the final figures for the year showed that 330,975 hp. of new business had been signed. The quota for 1931 is set at 350,000 hp. new business, which means continued effort.

This campaign for additional load is making southern California the most highly electrified section in the world. New adaptations of electric energy are in continuous process of exploitation, and these, with the new industrial and agricultural development and the increased use of electricity in the home, remove the likelihood of saturation. This new business can be developed as it should be only by planning ahead.

Comprehensive planning improves the individual members of the organization. Personal problems and business fundamentals enter into every one's daily tasks and, as he learns to think of them and plan their performance, he becomes more of a factor in perfecting the budget processes, stimulating his desire for performance and better results.

This is an age of realization, an age in which thought, not fortuitous circumstance, dominates industry. Progress results from thinking. One cannot think himself into ignorance. A budget system requires thinking in terms of established facts. This tends to make the individual a student of his work and, with the Southern California Edison Company, Ltd., has had the result that the individual job loses its deadening routine and more effective work is accomplished with less supervision.

One theory favored by economists is that the adoption of budgetary control by industry will lessen the wide swings from prosperity to depression which have been experienced in the past. There will always be times of greater and less prosperity, but there is the probability that such abnormal swings as we have experienced in the last few years would be minimized if each class of business were under control within and by itself. Southern California Edison Company, Ltd., is going through the depression period with a very small degree of curtailment, and its planning program is largely responsible for the showing that the company has made.

Budget procedures vary

Southern California Edison Company, Ltd., has made marked progress under the budget system. However, no uniform instructions could be written that would be unfailing in the making of a budget that would fit all classes of industry. Each class of business must meet different conditions and each should be responsible for budgeting its own results. Budgeting is not a function of one department or district, but is the concern of all who contribute to the common result.

In the last analysis, it is the attitude of the executive management which will determine the results achieved, because management alone is in a position to weigh the efforts of all departments and to pass judgment on the answer attained. Where the management gives close personal attention to the budget and is entirely in sympathy with it, there will no doubt result a co-ordination of effort which will go a long way toward the predetermination of future results.

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Bay State Board Seeks to Control Utility Loans

AROUSED TO ACTION by alleged unsound practices in extending loans to holding companies by operating organizations, the Massachusetts Department of Public Utilities has recommended to the incoming Legislature that jurisdiction be given the commission over loans by gas and electric companies to other corporations. The board points out that where loans to holding companies by operating subsidiaries are restricted to that amount of cash which the operating company would otherwise distribute in dividends, the interests of consumers would not be adversely affected. "On the other hand," says the commission, "gas and electric companies are organized to manufacture and sell gas and electricity and not to engage in the business of lending money. We believe that the lending of money the way it has been done is beyond the corporate powers of the companies so lending and might properly be attacked by a stockholder.

"Where a holding company has acquired most of the stock of an operating company, it can be used as a device to force the sale of the stock not owned by the holding company to it, largely upon its own terms. By not declaring dividends and lending its profits to other utilities controlled by it, a powerful influence is brought to bear upon the owners of small amounts of the stock to sell their holdings. We believe that gas and electric companies should be prohibited from lending money, other than advances to their own employees, to a limited amount (say $1,000), unless approved by the department."

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Comerford Attacks Growing Tax Burden

> Every weekday of the past two years it has cost the New England Power Association over $500 to furnish information to federal investigators, practically all of which was on file with the existing state commissions. Upward of a third of a million dollars represents the appalling expense of just one of these "wandering governmental inquisitions" to a single corporate organization in this short period, a striking example of wasteful duplication of functions already efficiently performed by the states.
>
> FRANK D. COMERFORD.

"AMERICAN business men will be unable to continue to carry the cost of government in the face of world-wide adverse conditions unless the waste of public money is stopped," declared Frank D. Comerford, president of the New England Power Association, in an address last week before alumni of the Harvard Graduate School of Business Administration. Referring to the mounting taxation burden of public utilities and its severe handicap upon rate reductions, Mr. Comerford said in part:

Between 1912 and 1930 the gross revenues of the electric companies of the country increased 700 per cent. Most people are familiar with this astonishing story in the growth of an industry. But how many people know that during the same 18 years the taxes paid by this industry increased 1,450 per cent?

During the present year the companies comprising the New England Power System will pay more than $5,700,000 in direct taxes to the cities and states in which they operate. This is an increase of $600,000 over corresponding taxes paid in 1930, and this additional burden comes at the time when the industry has suffered severely from the falling off in the takings of industrial power. In our system approximately 11 cents of the consumer's dollar goes for direct taxes, and in some of our companies, where we have to contend with an extravagant city or town government, the tax share of the dollar runs as high as 17 cents.

These figures suggest the difficulties which confront the companies when we are urged to make further reduction in our domestic rates. We have made reductions during this year which will mean savings of hundreds of thousands of dollars in lighting bills to customers in our territory. But it must be obvious that we cannot continue the downward trend in electric rates if more and more of our revenues must be turned over to some tax collector.

The figures I have given do not include the burden imposed on our industry by the federal government in the wasteful manner in which it duplicates functions already efficiently performed by the states. All our operating companies in New England are thoroughly regulated by state commissions. These commissions not only have the complete records of all companies but they are familiar with all the statutes which govern the conduct of the business. Yet during the last two years it has cost the New England Power Association more than $300,000 to furnish information to federal investigators, practically all of which was already on file with the state commissions. The waste from these wandering inquisitions, which are all too often floated for political purposes, has become appalling.

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October Revenue $6,000,000 Over September

OCTOBER REVENUE OF ELECTRIC light and power companies fell short of last year's by the largest percentage of any month thus far, although in almost any other industry the showing would be considered excellent. Reports thus far received by the ELECTRICAL WORLD, accounting for about 70 per cent of the industry, show a decrease of 2.5 per cent. This is equivalent to a change from about $183,000,000 in 1930 to $178,400,000 for the whole industry in the United States, exceeding the September revenue by fully $6,000,000. The average daily revenue was therefore 1 per cent greater than in the preceding month.

The decline, compared with 1930, was greatest in the midwestern industrial section, where it somewhat exceeded 6 per cent; it affected the majority of the companies in that geographical region. The South Atlantic and Pacific States reported approximately the same revenue as in 1930; New England alone gained slightly; other sections report a moderate decrease.

Plan to Safeguard Green Mountain Preferred Dividends

TO INSURE PAYMENT of the preferred dividends of the Green Mountain Power Corporation which fell due December 1 the New England Power Association, which acquired control of the company last week at an auction sale in New York, has been taking steps to ascertain whether the capital of the company has been impaired and to work out a plan for the regular distribution of earnings on the 6 per cent preferred stock of the Green Mountain company.

Following the advance of $1,500,000 by the association to the company last week to pay notes maturing at that time, President Frank D. Comerford announced that it is proposed to apply to the Vermont Public Service Commission for permission to cancel a sufficient number of shares of the Green Mountain corporation's common stock to facilitate the payment of the preferred dividend in case the company's capital is found to be impaired. The amount of the preferred dividend due December 1 was about $70,000, and Mr. Comerford stated that current earnings justify its payment. Many of the preferred shares are held by customers.

▼

Bond & Share Employee Stock Withdrawn

STOCKHOLDERS OF THE Electric Bond & Share Company ratified the cancellation of the plan for the sale of common stock to officers and other employees of the company and subsidiaries adopted in 1929. A minority group voted 13,575 shares to table the plan until further study, while more than 9,000,000 shares voted to terminate the plan.

Apparently 589,702 shares of Electric Bond & Share were involved in the withdrawal of the stock offer, including shares subscribed to and other stock and scrip issued as regular dividends.

As a result of the action of the stockholders the Electric Bond & Share Company will repurchase from a wholly owned subsidiary stock held against the subscriptions, which will be canceled.

▼

Seattle Power Bonds Will Be Sold to Citizens Direct

AN INNOVATION in the financing of the Seattle municipal light and power development will be inaugurated soon when the City Council offers for sale to the public $1,000,000 of municipal light and power utility bonds, part of a five-million-dollar issue authorized several years ago. The plan has the approval of Superintendent of Lighting J. D. Ross. The bonds will be issued in denominations ranging from $50 to $1,000 and will bear 5 per cent interest. They will be sold over the counter at the city hall. The Light Department's contract agents will also press a selling campaign among patrons of the system.

In proposing the bond issue Ralph D. Nichols, chairman of the finance committee of the Council, stressed the necessity of providing immediately funds to meet heavy construction accounts now due, chiefly on Skagit contracts recently completed. Included are contracts for the Diablo power house, tunnel and generating machinery and an order for transmission-line cable to cost $400,000.

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Weekly Output Larger

OUTPUT OF ELECTRIC light and power companies continues somewhat less than in the corresponding period of 1930, although the week ended December 5 shows a marked increase over the preceding one, which included a holiday. The table presents comparable weekly output figures as announced by the National Electric Light Association. The movement is essentially parallel with that of last year, the energy production during the past four weeks having been smaller, respectively, by 5.2, 3.9, 4.2 and 4.3 per cent than in 1930.

	1931	1930	1929	1928
October 31.....	1,652	1,741	1,816	1,688
November 7...	1,628	1,728	1,798	1,697
November 14...	1,623	1,713	1,794	1,696
November 21...	1,655	1,722	1,818	1,701
November 28...	1,600	1,672	1,718	1,619
December 5...	1,671	1,747	1,806	1,706

New England makes the best relative showing. In the week ended November 28 its output was about the same as last year; the Atlantic seaboard as a whole was down 1.4 per cent, the central industrial region 8.2 per cent, the Chicago district, alone, 7.0 per cent, the Pacific coast 2.4 per cent. Last week the corresponding percentages, beginning with New England, were 0.2 (loss), 0.8, 8.3, 6.1 and 4.1.

▼

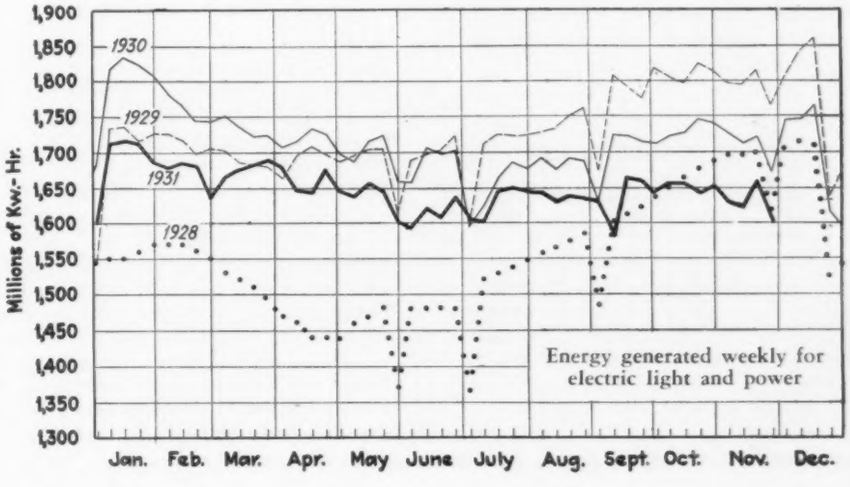
Approve Segregation of Water-Power Properties

AT A SPECIAL MEETING held this week the stockholders of the International Paper Company approved the program for the segregation of substantially all the water-power properties in the United States now owned or controlled by the company, including, among others, the powers on the Hudson River in the state of New York.

As an initial step, the directly owned properties, with minor exceptions, are to be transferred to subsidiary companies, all the stock of which will be controlled by International Paper Company. The company's interest in the properties will not be diminished by these transfers, but its ownership will be changed from a direct to an indirect one.

These transfers will facilitate consummation of the company's announced policy of ultimately segregating all its power properties under the control of International Hydro-Electric System. It was in accordance with this policy that International Paper & Power Company was formed in 1928 and that International Hydro-Electric System was formed in 1929 and acquired from the paper company the shares of New England Power Association and of Canadian Hydro-Electric Corporation, Ltd., which the paper company then controlled.

Arrangements for the acquisition by International Hydro-Electric System of control of the water powers to be segregated have not been completed nor have the terms as yet been settled by the respective boards of directors. The matter is, however, under consideration.



Business News and Markets

General Cable May Reduce Stock Value

STOCKHOLDERS OF THE General Cable Corporation will meet December 16 to decide on a proposed plan to reduce the stated value of common and class A stock from $17,280,881 to $10,280,881. It is understood that such a plan would facilitate earlier resumption of dividends on preferred and class A stocks.

The letter announcing the proposal states that the balance sheet as of December 31, 1931, will show a deficit of $5,801,601. If the plan is consummated the books will show, instead, a surplus of $1,198,399, it is understood. Surplus will not be used for payment of dividends, the letter states.

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Power Line Insulator Committee Approved

THE PERSONNEL OF THE technical committee on power line insulators for electric power lines (C29), which will function under the procedure of the American Standards Association, has been approved by the new electrical standards committee. The personnel was submitted to the committee for approval by the American Institute of Electrical Engineers and the National Electrical Manufacturers' Association, sponsors for the project. The personnel as approved, representing N.E.M.A., is as follows:

W. H. Burleson, Ohio Brass Company, Mansfield, Ohio; E. H. Fritz, Westinghouse Electric & Manufacturing Company, Derry, Pa.; G. W. Lapp, Lapp Insulator Company, Inc., Leroy, N. Y.; W. L. Stinson, Jeffery-Dewitt Insulator Company, Kenova, W. Va.; H. B. Vincent, R. Thomas & Sons Company, Lisbon, Ohio.

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Consolidated Industries Handles Conlon Products

ARRANGEMENTS HAVE JUST been completed between Walter J. Conlon, president of the Conlon Corporation of Chicago, and D. H. Pollitt, president of Consolidated Industries Products, Ltd., of Toronto, whereby the latter organization will manufacture and distribute Conlon ironers and washers for the Canadian market and all of the British possessions under a Conlon license.

These products will be marketed under the "Consolidated" trade-mark. Consolidated Industries Products, Ltd., has gained recognition for its activities in connection with the sale of Norge refrigerators, De Forest-Crosley radio receiving sets and Hammond electric clocks, which are also planned to carry the Consolidated name.

▼

Weston Electrical Profits Reduced Sharply

THE STATEMENT OF OPERATIONS of the Weston Electrical Instrument Corporation for the nine months ended September 30 shows net profit of $87,384, against $569,037 for the first nine months of 1930. This includes figures for the Jewell Electrical Instrument Company from June 12, 1931, to September 30, 1931.

Net profit for the September quarter was $16,728, against $10,012 in the preceding quarter, and $120,153 for the third quarter of 1930.

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Westinghouse Considers Wage Reduction

A REDUCTION OF 8 to 12 per cent in the hourly wage rates in force at all plants is being considered by the Westinghouse Electric & Manufacturing Company. Such a reduction goes into effect at the Springfield, Mass., plant January 1.

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Lincoln Electric in McGraw-Hill Building

ANNOUNCEMENT OF THE CHANGE of its New York office from 136 Liberty Street to the new McGraw-Hill Building, 330 West 42d Street, has been made by the Lincoln Electric Company of Cleveland, Ohio, manufacturer of "Linc-weld" motors and "Stable Arc" welders.

The new offices include a showroom of equipment and facilities for the demonstration of motors, welders, new electrodes and innovations in welding technique. G. N. Bull continues as district manager in New York.

Branch offices have also been established in Scranton and Allentown, Pa., D. Levenson being in charge of the first and F. Shackleton covering the latter territory.

Allis-Chalmers Order

AN ORDER FOR $1,000,000 worth of transformers and switchgear equipment has been received by the Allis-Chalmers Manufacturing Company from the Pennsylvania Railroad. Shipment will begin immediately. The new equipment is for use in the railroad's electrification project and the services of several hundred men will be required. Unfilled orders of the company as of November 30 were $8,229,000, against $8,101,000 as of October 31.

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Research Experts Form Industrial Service Unit

A NEW TYPE OF SERVICE organization, to facilitate the marketing of industrial products, has been formed by Dr. H. H. Sheldon, H. A. Morse, L. W. Hutchins and Dr. W. H. Easton, all well known in many branches of industry, engineering and science. The company, with offices at 191 West Tenth Street, New York City, will be known as Sheldon, Morse, Hutchins & Easton.

This group will give special attention to the economic problems arising in connection with scientific research by assisting manufacturers to determine the applications and markets for products in the laboratory or development stages, estimate the amount of research expenditures that are economically justified, make surveys of competition and patents, and plan supplementary research work and the development of new products to meet market conditions.

The company also plans to furnish manufacturers with a complete sales research, advertising and publicity service, based on the principals' experience in the promotion and sales of chemicals, electrical equipment, building materials, industrial and marine supplies and machinery, scientific apparatus and other lines.

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New York Metal Prices Remain Firm

	Dec. 2, 1931 Cents Per Pound	Dec. 9, 1931 Cents Per Pound
Copper, electrolytic	6.50	6.50
Lead, Am. S. & R. price	3.85	3.85
Antimony	6.35	6.25
Nickel, ingot	35	35
Zinc, spots	3.475	3.50
Tin, Straits	21.25	20.60
Aluminum, 99 per cent.	23.30	23.30

Westinghouse Receives Equipment Order

CONFIDENCE IN BUSINESS IMPROVEMENT is indicated by the $375,000 order for switching equipment which was recently received by the Westinghouse Electric & Manufacturing Company from the Commonwealth Edison Company for use in the latter's new Humboldt Park station in Chicago.

Chicago's 60-cycle electric current is supplied from a 66,000-volt tie-line which runs through the city from the northern boundary to the southeastern boundary and connects with lines of neighboring power companies. Four generating stations within the city feed electric current into this tie-line, from which the current is distributed by these same four stations and two additional switching stations. Humboldt Park is the newest of these switching stations.

The circuit breakers on order will connect the 66,000-volt tie-line to the buses of the new station, the station buses to transformers which will reduce the voltage to 12,000 and the transformers to 12,000-volt lines which conduct the current to substations in the Humboldt Park district.

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Kelvinator Profits Up 10 per Cent

NET PROFITS OF THE Kelvinator Corporation for the fiscal year ended September 30 amounted to $1,761,709, against $1,601,016 for the previous year. For the first time Kelvinator Corporation showed a profit in the July-September quarter. The full year's figures show a 10 per cent increase in earnings over the previous year and a gain of 44 per cent over the 1929 fiscal year.

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TRADE BRIEFS

Jay Kennedy, for the past seven years associated with the Frigidaire Corporation, has been appointed Pacific Coast regional manager for Copeland Products, Inc. The territory over which Mr. Kennedy will have jurisdiction comprises California, Washington, Oregon, Arizona and Colorado.

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R. B. Clark, sales engineer, is organzing to represent electrical and radio manufacturers for the territory of Ohio, Michigan and Indiana.

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Formation of a new organization, Wetmore, Scott Company, Inc., Boston, to handle the distribution of Westinghouse refrigerators is announced.

Air Preheater Corporation is now represented in Washington, D. C., by M. Day, with offices in the Chandler Building.

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The marine engineering group, general engineering department of the Westinghouse Electric & Manufacturing Company, has merged with the steam engineering department at the South Philadelphia works.

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A. R. Small, manager of the Underwriters' Laboratories in New York and chairman of the electrical committee of the National Fire Protection Association, is seeking nominations for a special subcommittee of ten or twelve members to consider the question of the permitted or required use of a new design of plug fuse and cut-out base for the National Electrical Code standard 0.30 amp. design.

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M. L. Cornelius has been appointed district manager at Cleveland, I. W. Lachman sales engineer at the New York office and W. J. Ehmer sales engineer at the Philadelphia office by the Riley Stoker Corporation.

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General Electric Will Pay Regular Dividends

THE REGULAR QUARTERLY DIVIDENDS of 40 cents on common stock and 15 cents on the $10 special stock have been declared by the General Electric Company. Both are payable January 25 to stock of record December 18.

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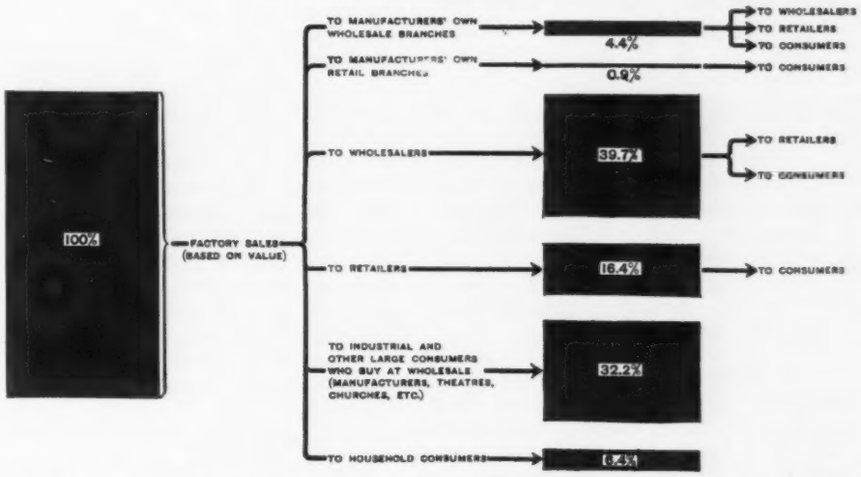
Lighting Equipment Sold Largely by Wholesalers



HOW MANUFACTURERS of lighting equipment distribute their products is summed up in a survey made recently by the Department of Commerce. Sales to wholesalers constitute about 40 per cent of the total. For 1929 total sales by such manufacturers amounted to $144,966,000 and $57,497,000 was sold to manufacturers.

Other sales were made as follows: To retailers 16.4 per cent, or $23,801,000; to manufacturers' own retail branches, 0.9 per cent or $1,275,000; to industrial and other large consumers who buy at wholesale, such as manufacturers, theaters, churches, etc., 32.2 per cent or $46,756,000, and to household consumers, 6.4 per cent or $9,217,000.

Manufacturing plants sold 4.4 per cent, or $6,420,000 worth of goods to their own wholesale branches. This report does not show the distribution of sales of these branches.

Of the above sales to dealers and industrial and other large consumers who buy at wholesale, $8,141,000 worth was sold through manufacturers' agents, selling agents, brokers or commission houses. Seventy-three manufacturing plants sold through such agents, fourteen of them selling their entire output in this way.

Attention is invited to Tables II and III of the survey, which show the sales channels employed by those manufacturing plants in the industry which are engaged principally in making electric residence fixtures and motor-vehicle lamps, respectively. The survey shows the sales channels employed by the 614 manufacturing plants engaged primarily in making lighting equipment during the past year.

Market Conditions

WHOLESALE distribution is somewhat better on the Pacific Coast in anticipation of the holiday season. Water systems and other utility projects are giving rise to a satisfactory volume of business in view of general conditions and construction activity is fairly well sustained.

——SOUTHEASTERN AND SOUTHWESTERN BUSINESS HAS SHOWN A FURTHER DISPOSITION to slow up and distributors are not particularly hopeful for the immediate future. Fractional-horsepower motors and day-to-day requirements show activity in New England, but otherwise there is little evidence of improvement.

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EASTERN

—EASTERN MARKET ACCOUNT *continues active in connection with railway electrification programs and sizable commitments are reported from that quarter; the business is being distributed among a number of manufacturers. Government awards have been easing off during the past few weeks, but there are prospects of early resumption, however, with current calls for bids for prime movers.*

—HOLIDAY TRADE IS SHOWING *more signs of life for electrical appliances and gift specialties, and while gross business is considerably lower than last year, the average is coming up to a better level. Street-lighting equipment is developing an encouraging tone and some worthwhile awards are anticipated during the next 30 to 60 days.*

Continuing its purchases of equipment for electrification work, the Pennsylvania Railroad Company has placed an order with Allis-Chalmers Manufacturing Company for transformers and accessories, switchgear and allied apparatus to an amount of about $1,000,000. An Eastern manufacturer of electric locomotive equipment has secured an order for immediate account totaling $75,000. General Railway Signal Company has been sharing in electrification programs and has a volume of business on hand considerably larger than at this time a year ago. American Locomotive Company is increasing production at its Schenectady works and adding to the working force.

Industrial activities are developing improved momentum in the right direction. This is shown not only with respect to plant schedules but in connection with expansion programs for factory facilities. The Underwood Typewriter Company will increase the capacity of its plant in Canada, with the Remington Typewriter Company arranging a move in the same direction. The steel industry is improving production schedules in the Pittsburgh district and a number of plant betterment programs are proposed with the advent of the New Year. The Bethlehem Steel Company will erect two new additions to its mill at Johnstown, Pa., and will make a number of improvements in operating equipment at that place. The Republic Steel Company will expend about $500,000 for a new steel strip mill at its plant at Massillon, Ohio. White Motor Company, Cleveland, has secured a record motor truck order aggregating over $2,500,000, the largest individual commitment since the World War, and will advance production.

Donovan Construction Company, St. Paul, Minn., has tendered a low bid for an ornamental street-lighting system at Evanston, Ill., at $1,007,109, using concrete standards, and $1,025,721, using metal standards; there were eight other bidders for the project. General Cable Company has secured an order for a quantity of lead-covered cable from a Pacific Coast city.

CONSTRUCTION PROJECTS

Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids until December 16 for surface condenser, motor-driven condensite pump, switchboard panel, electrical instruments, etc., for the Brooklyn, N. Y., navy yard (Specification 6680). Shampan & Shampan, Brooklyn, N. Y., architects, have plans under way for a multi-story printing and industrial plant to cost $300,000. City Commission, New Brunswick, N. J., plans installation of electric-operated pumping machinery in connection with filter plant project to cost $300,000. Board of Education, Pittsburgh, Pa., will receive bids until December 16 for shop power panels for Knoxville junior high school. Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until December 22 for turbine-driven generating units, condensers, air ejectors and auxiliary equipment for Philadelphia, Norfolk and Puget Sound navy yards (Schedule 7057); until December 15 for a high-potential testing set for Brooklyn yard (Schedule 7043).

NEW ENGLAND

—THERE IS LITTLE *to indicate any improvement in sales of electrical equipment in this district. Orders for small motors are fairly steady, according to one prominent manufacturer, and limited to single lots, while orders for fractional-horsepower motors show much more encouragement. Heavy machinery is dull, though negotitions are reported to be under way for plant improvements.*

Interest in electric furnaces is active, with one manufacturer recording steady gains in inquiries and encouraging prospects for orders for special-purpose units. General schedule materials maintain a low level in sales volume as compared with last year, though some seasonal pick-up is reported by one prominent manufacturer. New wiring construction contracts totaling about $100,000, principally in connection with institutions, are at present being figured and one recently let amounted to over $28,000 involving lighting and signaling systems for a state institution.

CONSTRUCTION PROJECTS

Blackall, Clapp, Whittemore & Clark, Boston, Mass., architects, have plans nearing completion for an automobile service, repair and garage building, estimated to cost $150,000. East Coast Ship & Yacht Corporation, New London, Conn., plans expansion and improvement program at ship repair plant, including new buildings, to cost close to $100,000.

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MIDDLE WEST

—THE SLIGHT IMPROVEMENT *observed last week in general business appears to be carrying over this week in this section and the volume of business appears to be increasing, even though slightly.*

—MAJOR ACTIVITIES CONTINUE *at about the same level, although some slight improvement is noted in the automotive field. Not much activity is expected in the automotive industry, at least on new models, until after the New York show.*

Several of the carriers here report a healthy increase in car loadings and the railroad situation looks to be a trifle more promising. Despite several announcements of 10 per cent cuts in wages, a more optimistic feeling is being evidenced generally.

Retail merchants report an unusually heavy pre-holiday week and wholesalers are practically satisfied. The various utility companies are carrying on quite a little circuit revision work and while new construction is lagging, special

maintenance work is increasing. Some of the interesting items placed this week include three 13,000-amp., 225-275-volt synchronous booster lighting converters and elevator equipment to cost $42,000.

CONSTRUCTION PROJECTS

Treasury Department, Washington, D. C., will have plans drawn for a post office at Menasha, Wis., to cost $120,000. Ohio Edison Company, Springfield, Ohio, plans transmission lines and power substation for service in Medina, Ohio, district, to cost $100,000. Patterson Foundry & Machine Company, East Liverpool, Ohio, is completing plans for power plant for industrial service, to cost $75,000. United States Engineer Office, St. Paul, Minn., is asking bids (no closing date stated) for one-story power plant at Twin Locks, Minneapolis, Minn. Village Council, Spring Valley, Minn., is asking bids until December 15 for three Diesel engine generating units with accessories.

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SOUTHEAST

—WORK ON NEW BUDGETS *and the depleted condition of this year's budgets were reflected in activities in the Southeast last week. Large equipment is very quiet and even appliance lines, usually very brisk at this period of the year, are not all that could be asked. The 4,000-kw. turbine order in the Carolinas reported last week has been cancelled.*

One of the larger power companies last week ordered induction regulators amounting to $6,650, while its cable and guy wire orders aggregated $6,300 and its transformer purchases totaled $4,000. An oil company in Louisiana ordered three 200-hp. synchronous motors and control and a lumber company in Florida purchased a frequency changer set and control costing around $2,000. An industrial in Georgia ordered $2,000 worth of motors and a textile in the same state ordered motors and control equipment costing $1,000. One Georgia municipal plant ordered $2,000 worth of line construction materials, while two others placed carload orders for poles. A textile mill under construction in Georgia has purchased 75 electric ranges for its mill village.

CONSTRUCTION PROJECTS

Ford Motor Company, Dearborn, Mich., contemplates storage and distributing plant, with enameling and other mechanical departments, at Alexandria, Va., to cost over $100,000. Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until December 15 for attachment plugs, snap switches, lamp sockets, etc., for Hampton Roads, Va., navy yard (Schedule 7015); at same time, for an electric furnace (Schedule 7022) and electric hoists (Schedule 6977) for the same yard.

PACIFIC COAST

—WHOLESALERS REPORT *a slightly better volume as well as a better distribution both as to source of buying and class of material. Staples are moving better and in better quantities.*

—POWER COMPANY PURCHASES *are featured by stock sizes of meters and distribution transformers, the former for the Fresno district and the latter for the central California area. Snowfall is heavier than for several years past, auguring brisk irrigation machinery business in the spring if other factors remain constant.*

Machinery prospects include additional equipment for pumping Hetch-Hetchy water to San Francisco over the coast range, such as six 1,667-kva. transformers and ten 1,000-hp. motors. A special commission is investigating a means of financing and constructing state-wide water distribution, about $170,000,000 being urgently needed in four distribution and pumping areas. A recent $215,000,000 Los Angeles water project, for example, is expected to provide close to $1,000,000 worth of electrical construction in 1932.

Orders include $2,000 worth of General Electric motors and controls for elevator manufacturer, a 760-kva. auto-transformer, additional press drive equipment for a San Francisco shopping bulletin, a $4,000 award for ornamental boulevard lighting for San Francisco and $40,867 award for similar equipment for Los Angeles. Prospective business includes about $50,000 worth of substation regulators and transformers in accordance with the announced policy of rebuilding and re-equipping various substations in the central California area.

With the exceptions of refrigeration and midget radio, a canvass of Seattle jobbers shows that the Christmas sales volume is off from 15 to 25 per cent, with several inclining toward a larger figure. Refrigeration, said to be about 5 per cent better, radio from 5 to 10 per cent heavier and electric ranges holding steady. Movement of domestic appliances and electrical giftware is extremely light. There is no improvement in motor apparatus and wire sales and indications are not considered bright. Sales reported include twelve motors from 20 hp. down to miscellaneous small industrials, 30 machines from 50 hp. down to pulp and paper and lumber mills for replacements only, about $750 worth of miscellaneous switchgear, ten transformers from 25 kva. down and eight motors from 35 hp. down to miscellaneous sources, fifteen motors from 25 hp. down to dealers, 40 motors from 10 hp. down, mostly fractional sizes, to miscellaneous industrials, and 35 motors from 75 hp. down to industrials, agricultural and mining sources and 40 transformers from 50 kva. down to central stations in the Puget Sound area.

Bids are being received at Yakima, Wash., until December 30 for the construction of the Prosser power canal power plant and for alterations to Prosser diversion dam, Kennewick division, of the Yakima project, the work involving installation of about 50,000 lb. of gates and gate lifts and erecting a power plant building.

CONSTRUCTION PROJECTS

Treasury Department, Washington, D. C., is having plans drawn for a post office addition at San Francisco, Calif., to cost $750,000; also for post office at Marysville, Calif., to cost $150,000. State Board of Education, Sacramento, Calif., is having plans drawn for a science building at the State Teachers' College, San Francisco, Calif., to cost $135,000. Constructing Quartermaster, March Field, near Los Angeles, Calif., will receive bids until December 15 for a floodlighting installation. Bureau of Reclamation, Denver, Colo., will receive bids until December 30 for construction of power plant, power canal and work in connection with diversion dam, Yakima project near Prosser, Wash.

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SOUTHWEST

—THERE HAS BEEN *a general slowing up in the Southwestern district and the bright prospects of a few weeks ago have not materialized the way manufacturers and distributors of electrical products had hoped for.*

An order for about $3,000 worth of motors has just been placed by a general contractor, that being the only sizable contract to go through this week. An Iowa municipal plant has bought a generator in connecton with a Diesel engine unit and also an electrically operated turbine blower. Smaller items of merchandise are moving only in fair volume and on the whole November and the first week of December ran behind the average for October. Christmas buying is beginning to manifest itself in some lines and within a week or ten days should be in full swing.

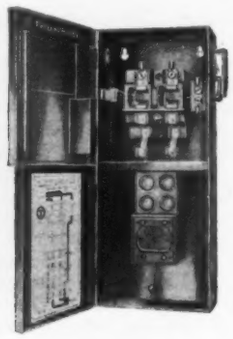
CONSTRUCTION PROJECTS

Doniphan Hydro-Electric Company and Current River Power Company, R. A. Long Building, Kansas City, Mo., will have a hearing early in January on application for proposed hydro-electric generating plant on Current River, near Doniphan, Mo., to cost over $1,000,000. Board of Education, St. Louis, Mo., plans manual training department in new high school to cost $900,000. Treasury Department, Washington, D. C., is asking bids until December 28 for post office and court house building at Okmulgee, Okla.

New Equipment Available

Combination Range and Entrance Switch

A COMBINATION RANGE AND entrance switch with branch circuit cutouts has been announced by the Trumbull Electric Manufacturing Company, Plainville, Conn. This device can be furnished in accessible or sealable main fuse types.



The entire device is in one box having two sections, each section having a separate cover. The upper section contains a fusible main switch, three poles, two blades, two fuses and a neutral terminal and the lower section, a two-pole, 60-amp., dead fuse puller and either two, four or six branch circuit cutouts.

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Absolute-Pressure, Recording Gage

A DIRECT-READING, SINGLE-PEN, absolute-pressure gage of the recording type has been announced by the Bristol Company, Waterbury, Conn. The use of high vacuum is an important factor in many production processes. This instrument eliminates any possibility of confusion or delay resulting from applying barometric corrections to vacuum readings, it is claimed, and can be furnished as low as from 0 to 50-mm. head of mercury pressure absolute or equivalent.

The actuating mechanism consists of two extremely sensitive diaphragm elements. One is connected to the vacuum line and the other is directly affected by barometric pressure variations. The resulting movements of these elements are transmitted by a differential transmitting linkage to a single-pen arm which permanently records on a suitable chart.

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AUTOMATIC OILING IS OFFERED in connection with the new fractional-horsepower condenser start induction run motor manufactured by the Howell Electric Motors Company, Howell, Mich. This new electric motor feature has two oil wells, one for each bearing, each having a reserve capacity of 2 cu.in. of oil. This is ample to provide proper lubrication over an extremely long period of time without adding new oil or giving it further oiling attention. These wells are filled at the factory with SAE 20 grade oil.

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Pumpless Oiling System

AN AUTOMATIC OILING SYSTEM for industrial machinery that operates electrically without pump or other moving parts has been developed by the Motor & Plane Accessories, Inc., Detroit, Mich. It consists of an oil tank made by Westinghouse equipped with an electric heater unit which is separated from direct contact with the oil. When the machine is started the heater is automatically turned on.

The rising oil temperature causes expansion and forces oil out of the tank to the bearings, where proper metering devices control the flow of oil. After the temperature has reached 150 deg. a thermostat breaks contact and allows the oil to cool to 100 deg. At that temperature the thermostatic switch again makes contact.

During the cooling process a vacuum occurs which is utilized to refill the tank from a central supply or reservoir. There is no time during the operation that there is a lack of pressure in the feed line, it is claimed.

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AN UNDERGROUND BOX made in three loads, top terminals, and two sources of supply, bottom terminals, each with its own disconnecting links, has been announced by the Delta-Star Electric Company, Chicago. In addition, the box can be sectionalized and the center load carried on either of the two sources. The use of such boxes aids in securing continuity of service, for if trouble develops it can be quickly located.

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A COMPLETE LINEMAN'S AND POLE-SETTING OUTFIT has recently been installed on a 157-in. wheelbase, 1½-ton truck for the Chesapeake & Potomac Telephone Company of Virginia by the Baker Equipment Engineering Company, Richmond, Va. This equipment consists of power winch, pole-setting derrick, lineman's body, collapsible reel and trailer towing hook.

Polyphase Switchboard Watt-Hour Meters

TWO POLYPHASE SWITCHBOARD watt-hour meters, designated type DS-21 and DS-23, have been announced by the General Electric Company. An outstanding feature of the new meters is a switch-and-link arrangement by which the current coils can first be shunted and then completely isolated from the line. Direct connections can then be made to the current coils for test. The meters utilize the I-16 element, insuring long-range accuracy with high torque and temperature compensation, as do the other instruments in this line.

Two self-contained ratings are available, 5 and 10 amp. Above these values of current transformer-rated meters must be used. The type DS-21 is a two-element meter designed for use on three-wire, two- and three-phase circuits and four-wire, two-phase circuits. The type DS-23 meter is a three-element instrument for use on four-wire, three-phase circuits.

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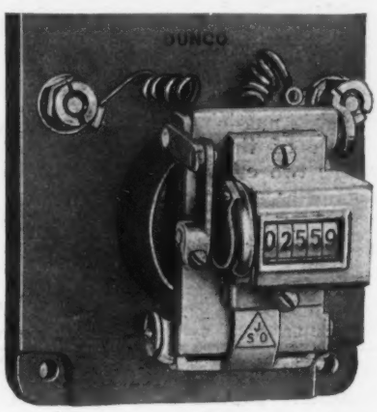
Electric-Magnetic Counter

AN ELECTRIC-MAGNETIC COUNTER designed and built on the same principles as the "Dunco" relays is announced by Struthers Dunn, Inc., Philadelphia. The unit is compact and mounted on a base 3x4¼ in. Over-all dimensions are 3½ in. The counters can be furnished for various voltages, a.c. or d.c., equipped with straight shunt coil or series, the coil consuming approximately 8 watts. It is designed for continuous duty.

Type EC-1 is designed to operate up to 75 impulses per minute. Type EC-2, reset, can be actuated to a speed of 350 impulses per minute, according to application. They may be used in conjunction with photo-electric cell, remote recording production, vending machines equipped with electric contacts, remote counting of revolutions and can be used on any equipment where electrical contacts can be actuated.